JANUARY 1949

Plant Engineering

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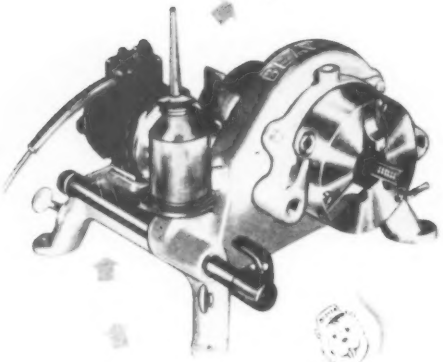
Volume 3, No. 1

The magazine that helps plant engineers with their everyday problems

2 BEAVER-BUILT PORTABLE POWER UNITS WITH SPECIAL SERVICE FEATURES



Model C-1—Converts hand tools into electric power tools for cutting and threading pipe.

Model C-2—Portable Unit as is C-1. C-2 has vise attachment.

YOU CAN BUY BEAVER TOOLS WITH FULL CONFIDENCE

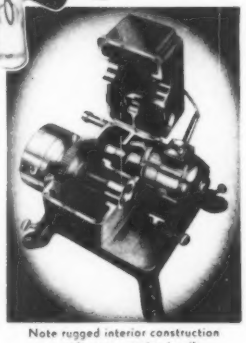
"Beavers cut easily"

When you buy Beaver Portable Power units to mechanize cutting, threading and reaming of pipe, you can expect trouble-free performance . . . and you'll get it at lower cost. You will be changing your pipe tools into electric tools that are easier, faster and safer to use.

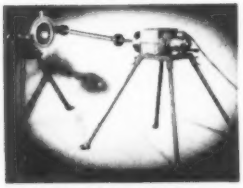
Look at these Beaver construction advantages . . . time-tested by thousands of users.

1—Fully enclosed gear case . . . gears run in oil;
2—Patented outboard pipe steady-rest . . . prevents pipe whip from "rocking" the spindle—better threads;
3—Patented safety latch . . . prevents dangerous rotation of pipe-tool handle;
4—Motor exposed . . . for ventilation and accessibility;
5—Model C-2, vise equipped . . . may be used by two men;
6—Standard 1/8" to 2" heavy duty chuck.

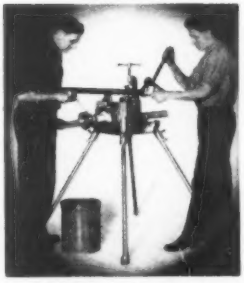
Here's an easy way to modernize at low cost. Write today for data.



Note rugged interior construction — with gears running in oil.



Threading 8" pipe in six minutes with Beaver 80 E-threader and Model C.

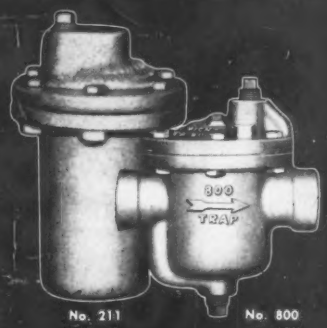


Model C-2—Here two men work without interference.

49 Years of Friendly Service

BEAVER PIPE TOOLS, INC.

210-300 DANA AVE. WARREN, OHIO, U. S. A.



No. 211 No. 800

Above left — Armstrong bottom inlet—top outlet series trap.

Above right — Armstrong No. 800 side inlet—side outlet trap.

PROOF THAT ARMSTRONG TRAPS PAY DIVIDENDS:

$26,119.62 FUEL SAVINGS after installing new heating system and individually trapping all mains, risers, coils and unit heaters with Armstrongs. —*L. G. Balfour Co., Attleboro, Mass.*

•

SAVE 3723 GALLONS OF FUEL OIL annually after installing Armstrong traps on kettles and other equipment. —*Mary Lincoln Candies, Inc., Buffalo, N. Y.*

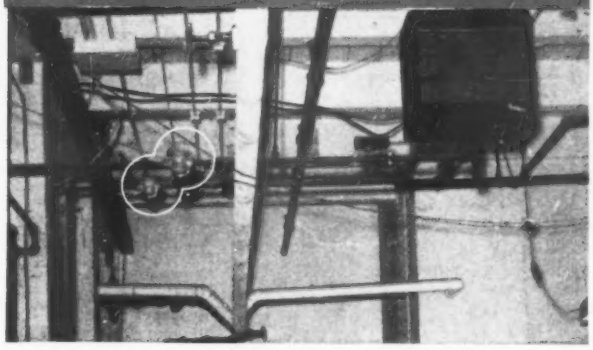
•

20% COAL SAVING at Norton Greenhouses, St. Paul, Minn., resulted after heating coils were individually drained by Armstrong "blast" traps with thermic air vents.

•

15% FUEL SAVING due to Armstrong traps at Sun-Ray Cleaners, Chicago, Ill.

FUEL BILLS TAKE A NOSE DIVE



When You Unit Trap with Armstrongs

Any plant operator or engineer may ask, "Why should I expect to save fuel if I invest in Armstrong Unit Trapping?" The answer is simple:

1. *Armstrong traps can't leak steam*—the hardened chrome steel valve and seat are ground and lapped to a precision, steam-tight fit; they are water sealed at all times. When steam enters the trap, the bucket floats and closes the valve. Full steam pressure against the valve holds it closed—*tightly!*

2. *Non-productive radiation losses minimized*—with Armstrong traps on the job, the steam gives up more heat through the machine, less through the supply and return lines. Air and condensate is discharged as rapidly as it accumulates; heat transfer efficiency in the machine is greater; flow of steam in is more rapid; condensate is discharged at steam temperature — no "cooling legs" needed.

3. *Faster Production*—because Armstrong traps keep equipment HOT, drying, evaporating, cooking, heating and other processes are faster. It takes less steam when it takes less time to complete a heating cycle.

But, the "reasons why" make dull reading compared to the PROOF—see the column at the left. For recommendations and prices on traps for each piece of equipment in your plant send for the 36-page ARMSTRONG STEAM TRAP BOOK.

ARMSTRONG MACHINE WORKS
912 Maple Street • Three Rivers, Michigan

ARMSTRONG *Inverted Bucket* STEAM TRAPS

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'Round About with the Editors

Oldest Air Conditioning Job?

Contributed by
C. C. Cheyney

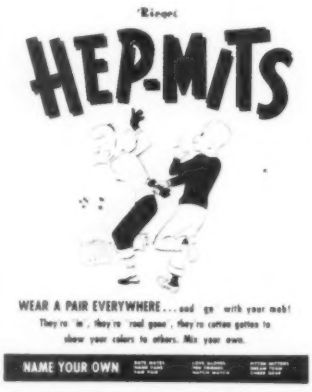
IN YOUR September 1948 issue you asked which was the first factory in the United States to install air conditioning.

The oldest air conditioning job we have been able to find is a layout made for the Wilhelm Realty Co. of New York City, in 1902. I believe this went also under the name of Sackett and Wilhelm.

The layout drawings were made in the New York Office of the Buffalo Forge Company in 1902. We have two of the tracings in our file, drawing number N.Y. 596, dated July 17, 1902, and N.Y. 599, dated September 15, 1902. These drawings show the general arrangement of apparatus including circulating fan, water cooling coils, refrigeration coils, ammonia condenser, heaters and duct work.

You Date Mates Got Your Hep Mits?

NATCH MATCH, These Fitten Mittens are cotton gotten for Pen Friends. Nope, we didn't make that up. It came in along with a sample pair of gloves—one red and one yellow—from Riegel Textile Corporation who swears by all they hold dear that Peggy Ann Garner, the Slick Chick from the West Coast, idead these gloves.


Riegel
HEP-MITS
WEAR A PAIR EVERYWHERE... and go with your mob!
They're in, they're real gone, they're certain gotten to show your colors to others. Mix your own.
NAME YOUR OWN

And now, just as we are getting warmed to the subject, we come to the last paragraph in the release. The first part tells how little teen agers are pounding each other over the head and getting all cut up generally in their mad, frantic efforts to be first in line with the Hep Mits. "Overnight," the release blandly states, "a fad was born." Then, the payoff:

"It wasn't long, however, until industrial users began buying the gloves as well. Some plants decided to try them out for identification purposes between various divisions and job classifications just as the Navy uses colored sweaters for quick identification on carrier decks. Other plants are trying them out for safety purposes, using red gloves to remind the wearer of ever-present danger to his hands in a particular operation."

Come on, Fair Pair, get your Dream Team Love Gloves.

Suppressing Noise in Water Heaters

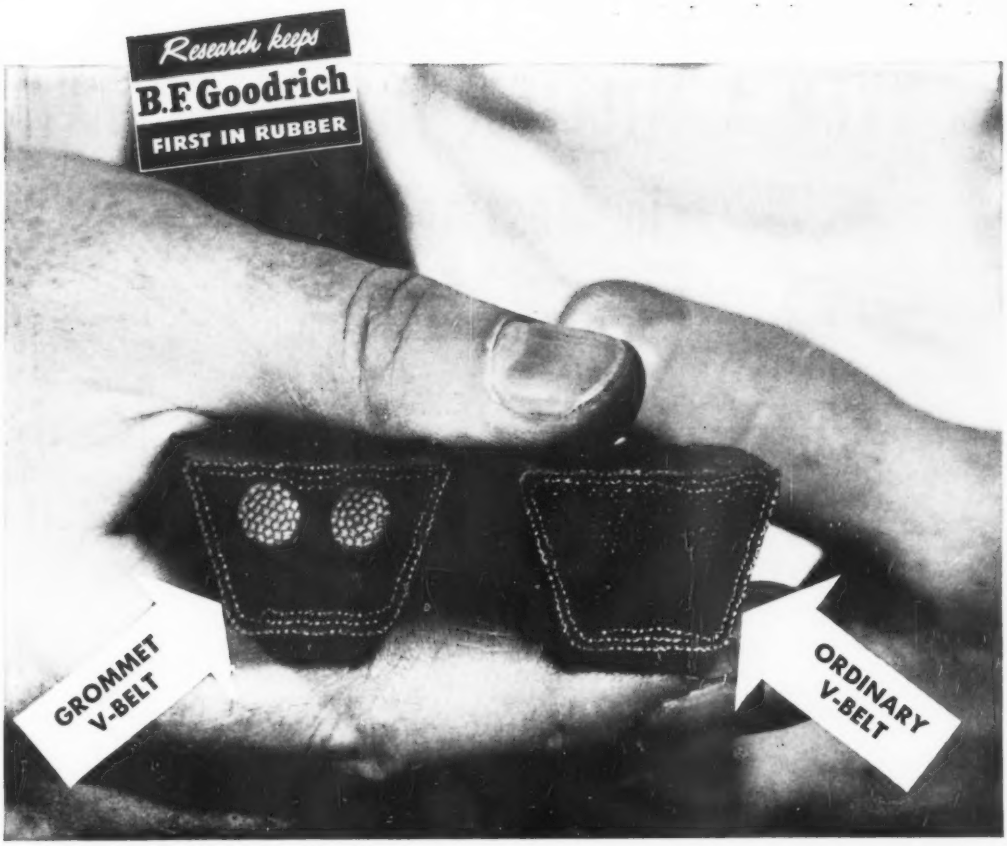
Contributed by
Walter Frye

WITH REFERENCE to the article by Prof. William R. Olsen on "Supressing Noise in Direct Mixing Water Heaters" (PLANT ENGINEERING, Oct., p. 38) we had a similar problem in our large canning retorts, when we changed them so we could cook canned products with water bath at around 180 F.

We installed the conventional water mixers but experienced a great deal of noise. We overcame the trouble by inserting a length of about 20 ft of copper tubing between the end of the steam line in the water and the mixer. Sufficient heat was absorbed by the water surrounding the copper tubing so that there was practically no noise from the mixer.

Our experience was that the greatest noise occurred when the water was cold, and as the water became heated, the noise stopped entirely.

Plant Engineering is published monthly at 55 W. Jackson Blvd., Chicago 4, Ill. Subscription price $10.00 per year to U. S. A. $11.00 to Canada. $12.00 to other countries. Single copy $1.00. Application is pending for acceptance under Act of June 5, 1934



Cut V-belt costs 20 to 50% with new B. F. Goodrich grommet V-belt

Lasts longer, stands shock loads better, costs no more

A NEW patented construction by B. F. Goodrich puts all the cord material in a V-belt to work in the form of twin, endless, extra-flexible grommets — *not* cables — placed close to the driving faces of the belt (see left, above). No "lazy" cords in the interior to shirk their share of the load. Because grommets are endless they are more flexible, with no stiff section such as occurs in an ordinary cable, with spliced or overlapped ends.

Why twin grommet construction? When an ordinary large-sized V-belt (right, above) goes into the sheave its sides are squeezed by the pulley, forcing the center cords downward and out of the line of load-carrying stress. Belt men call this "dishing", because the cord section becomes concave, like a dish. With twin grommet construction there are no center cords, no "dishing" — as the belt goes into the pulley the grommets remain on the job, close to the driving surfaces of the belt.

Grommet belts take shock load better, last longer — Laboratory and field tests show that grommet belts have a higher safety factor, greater ability to withstand shock load, than ordinary V-belts. Reasons: no "lost" or "lazy" cords to shirk, greater flexibility, better gripping power. Grommet belts tested lasted from 20 to 50% longer than ordinary V-belts. Reasons: no cord overlaps (85% of ordinary V-belts fail in the overlapped section), no sawing cords, less heat.

How to get genuine grommet V-belts — Twin grommet construction is an exclusive, patented B. F. Goodrich development — no other manufacturer can make grommet V-belts. Now available in "D" and "E" sections. To be sure you get genuine grommet V-belts see your B. F. Goodrich distributor. *The B. F. Goodrich Company, Industrial Products Division, Akron, Ohio.*

B.F.Goodrich
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OVER A MILLION INSTALLED KVA

in Westinghouse

Dry-Type Power Centers

"A million installed kva" in itself is not important. What is important is that these modern Dry-Type Power Centers are doing an efficient job . . . a job of meeting today's production problems by providing *dependable* and *economical* distribution of power.

They combine the necessary high-voltage switching equipment, a dry-type transformer, low-voltage switchgear and the necessary auxiliaries into a compact, completely enclosed and fully co-ordinated unit.

Their "Unitized" design permits the addition of feeders as required by changes in the load. They can be installed quickly and at low cost . . . *near the load center.* This reduces losses and improves voltage regulation. Long runs of costly copper are eliminated. Add to this the other advantages of Dry-Type Power Centers . . . fire and explosion-proof . . . no vaults required . . . lighter weight. These are the reasons it will pay you to investigate modern Dry-Type Power Centers for your distribution systems.

Modern Westinghouse Dry-Type Power Centers can be supplied for use in any distribution system whether radial or network . . . where the high voltage is 15 kv and below. CONSULT WESTINGHOUSE. Call your nearest Westinghouse office or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-97135

Indoor Dry-Type Power Center with primary switch and built-in panelboard.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

What is YOUR power distribution problem?

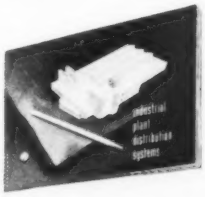
The importance of a power distribution system in an industrial plant makes it almost imperative that the *best system* be selected and included in the very basic planning for expansion or new building.

The problems of power distribution vary greatly from plant to plant. Meeting these problems for widely diversified industries has given Westinghouse an intimate knowledge of fields that undoubtedly closely touch *your* problem. Westinghouse offers complete cooperation to all industries in searching out better answers to all phases of the distribution and application of power.

★ ★ ★

Write for the new booklet "Industrial Plant Distribution Systems"

If you're considering expanding or building a plant, you'll find this booklet invaluable in choosing a distribution system that best meets *your* requirements. Ask for B-4045.



A Dry-Type Secondary-Network Power Center installed in a large mid-western industrial plant. Note it is located in the immediate load area which it serves.

MODERN EQUIPMENT FOR MODERN DISTRIBUTION SYSTEMS

Plant Engineer's Digest

Short articles selected from current publications and condensed for quick reading to save time and give quick reviews of a wide range of industrial topics

Inspecting Float Trap

IT IS DESIRABLE at times to check whether a trap is functioning properly. This can be done, with a trap installed as in the illustration, by closing the valve on the outlet side of the trap and opening the test valve. The trap will then discharge to atmosphere. It can then easily be determined whether the trap is tight, since, in a properly functioning trap, operating intermittently, there will be no flow after the condensate has been discharged. During flow periods which flashes into steam should not be construed as vapor loss. Frequency of testing and inspection will vary with operating conditions. One large plant has adopted a maintenance program of testing all main line or unit traps ¾ in. and larger every day, and the traps under ¾ in. on production units at least every six months.

To inspect the internal parts of an inverted float trap, the inlet and outlet valves to and from the trap should be closed, and the blow-off or test valve opened to relieve the pressure in the trap. If, under these conditions, it is desirable to continue removal of condensate, the by-pass valve disc should be held in a throttling position. After removal of the cover, inspection or repairs can be readily made while the trap is on the line. The trap can be completely removed from the line by simply loosening the unions.

If a trap should fail to operate efficiently and the reason for it not known the following suggestions may help in locating the cause:

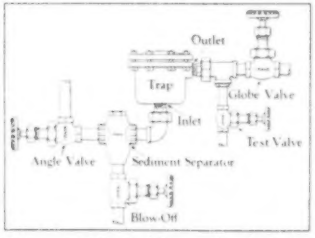
1. If the trap functions, but the system does not get hot, the trap may be too small for the job.

2. Check the pressure stamped on the cover of the trap with the differential pressure. If the differential pressure is higher than the figure given on the trap, a smaller seat orifice should be installed and the trap re-marked for the proper pressure as a record for future reference.

3. Vacuum on the discharge side of the trap may act against the opening of the trap and must be added to the gage pressure reading expressed in pounds pressure.

4. Check whether the seat orifice or the vent hole in the float is clogged. Trap should be cleaned and inlet line blown until thoroughly clean.

5. If no condensate is coming to the trap an elbow or pipe may be clogged, or valves on the line may not be open.—*From issue No. 3, 1948, Valve World, a publication of Crane Co., 836 S. Michigan Avenue, Chicago 5, Ill.*



Arrangement of piping and valves for a typical inverted float trap installation. By-pass should be added if system is to be operated continuously

Cut Down Infra-Red Lamp Breakage

THE IMPORTANCE of protecting infra-red lamps from breakage and of preventing combustibles from coming in contact with them, are the outstanding lessons from a recent study of 38 dryer fires in Factory Mutual plants since 1941. The fires occurred in dryers handling a wide variety of materials such as sprayed, dipped, and brush-painted metal parts, impregnated electric coils, coated paper, cloth and wood.

Hot parts of broken lamps igniting paint residues, flammable vapors, cloth or paper was the leading fire cause, the study disclosed. Some lamps were broken by paint dripping from materials being dried, and others by the falling or bumping of objects improperly hung on conveyors. A few lamps cracked or broke from no apparent external cause.

Most of the remaining fires were caused by heat from the lamps, which ignited work stalled while passing through the dryer or set fire to accumulations of residue or combustible parts of dryers.

The principal damage was the shattering of the hot lamps when suddenly cooled by water or other liquids used to put out the fire. An extinguishing agent which will not cause this damage is recommended. The sudden rise of temperature in a fire may also break the lamps. The experience of these fires and other preventive suggestions may be summarized as follows:

Protect lamps from spray, drip, splash or condensation which may break the lamps or ignite them by overheating. Protect lamps against mechanical breakage by work on conveyors.

Prevent hot parts of broken lamps from falling into dip tanks or onto combustible work, deposits or debris.

Provide sufficient dryer ventilation to prevent formation of combustible or explosive atmosphere in contact with infra-red lamps.

Provide interlocks to shut off lamp current when the conveyor stops, ventilation fails, or there is a breakage of continuous paper or similar material being dried.

Cut off dipping or spraying processes using infra-red-lamp dryers and protect against floor leakage.

Use only CO_2 or dry chemical extinguishing equipment (fixed or manual) in infra-red dryers. Tests at the Factory Mutual Laboratories show that carbon dioxide will not break the hot lamps, even when discharged directly on them in the form of "snow." Protect lamps from sprinkler water.

Construct infra-red-lamp dryers of strictly non-combustible materials. Install electrical equipment properly and maintain it well.

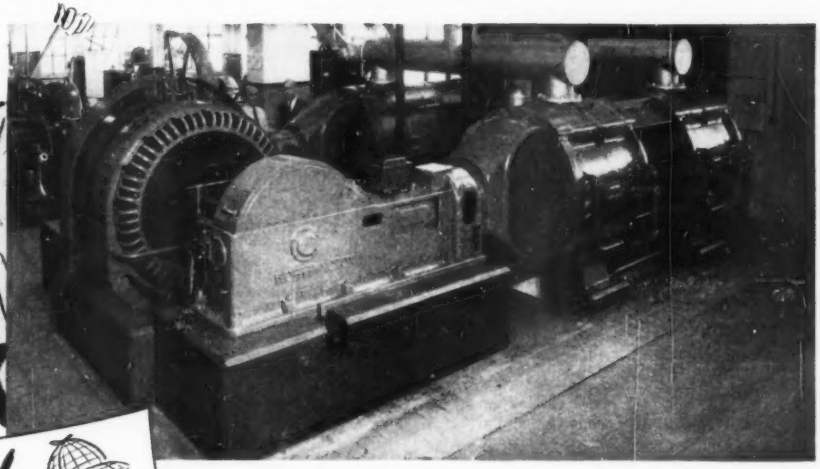
Avoid changes or experiments in infra-red dryer operations without complete safeguards. Use extreme care with portable infra-red drying lamps, particularly in hazardous locations.—*From the October 1948 issue of Factory Mutual Record, a publication of Associated Factory Mutual Fire Insurance Companies, 184 High Street, Boston 10, Mass.*

Tamper Team Cuts Costs

ENGINEERING ingenuity permitting a battery of six backfill tampers to be operated simultaneously by a three-man crew, has achieved time and labor saving of more than 50 per cent on a Texas job, it was reported recently.

The six tampers are mounted in a frame which also carries a manifold feeding all six machines from a single air hose connected to a 125 ft Jaeger compressor holding 95 lb of receiver tank pressure. The tamping unit is suspended from a side boom

NOW...it's a long time between inspections!



Worthington 32 x 16 Twin Tandem Horizontal Duplex Dry Vacuum Pump at Buffalo Electrochemical Co., Inc.

Worthington triples the running time of previous installation

After searching investigation, this Worthington Dry Vacuum Pump was selected to replace highly recommended imported pumps which alone were thought capable of handling highly oxidizing and corrosive gases.

One deciding factor was the famous Worthington Feather* Valve — the lightest, tightest, quietest ever made. After an initial 10-week run, it was found that this and the many other advanced Worthington features had turned in a performance exceeding that of the imported pumps. Since then, the Worthington Pump has operated on regular 10-week periods between inspections and cleaning — *as compared with previous 3-week periods!*

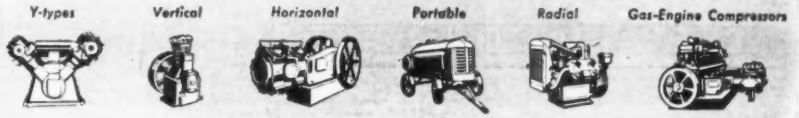
GET THE DETAILS

All through industry, Worthington Horizontal Dry Vacuum Pumps are leaving records of better-than-expected performance . . . piling up proof that *there's more worth in Worthington.* Bulletin L-710-B1B gives you the reasons why. Write to *Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, N. Y.* *Reg. U. S. Pat. Off.

WORTHINGTON

K8-4

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON



Texas tandem tamper with battery of six frame-mounted tampers suspended from a boom, enables three men to do the work of six. The strange but effective device, engineered by the Killian-House Construction Co. of San Antonio, cuts tamping costs upwards of 50 per cent

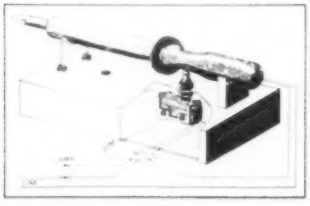
on the rear of a D-4 Caterpillar tractor, controlled by the compressor tender.

In operation the tamper frame is raised or lowered on the boom by means of a chain block, handled by one of the three-man crew, while the other two swing the frame back and forth.—*From the November 5 issue of The Thor Scoreboard, issued by Independent Pneumatic Tool Co., Aurora, Ill.*

Automatic Off-On For Soldering Iron

FOR THIS application put a lamp and a Micro precision switch in series with the soldering iron, so that when the iron is put on the stand the lamps acts as a series rheostat keeping the iron at reduced standby heat. This also has the advantage of saving tip retinning. The size of the lamp regulates the standby heat and the iron comes up to full heat immediately after picking it off the stand. This causes the switch to short out the lamp, thereby applying full voltage to the iron.

The switch should be put at the handle end of the iron so as to keep the heat from being transmitted to the switch. The lamp can have the pilot bezel in front of it so that light

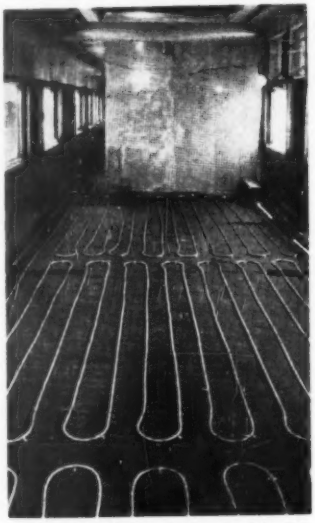


This drawing shows the general arrangement of the soldering iron, lamp and snap-action switch

will indicate that iron is operating. All the items are mounted in a small metal box which also acts as a stand for the soldering iron. *From Micro Tips, a publication of Micro Switch, Freeport, Ill.*

Radiant Heat Takes to Wheels

THE CONSTRUCTION of the car floor for Mexican President Aleman's car consists of a ¼ in. thick steel plate. On tap of this is a 1¼ in. thick oak board flooring and on top of the oak floor is a corrugated zinc sheet, the corrugations being on about 1 in. centers. The copper heating coils are ⅜ in. Type L. The tube is laid out on top of the zinc sheet with strips of building paper separating the



Radiant heating is being installed in the deluxe private railway car constructed for President Aleman. The radiant heating in this car is the first installation of this type

tube from contact with the zinc. A 1¼ in. thick mastic flooring was poured over the coils, embedding them. On top of this mastic is ¼ in. thickness of sponge rubber and a broadloom carpet is laid over the floor.

The heat generating unit is enclosed in an insulated steel box suspended below the car. Return risers from each separate coil are carried upwards in the side wall to a return main located in what might be termed the attic of the car where an expansion tank and automatic air release are located. In each return riser is a thermostatic valve to control the temperature of the individual rooms. The mechanical equipment consists of a steel storage tank in which are inserted two heat exchangers. Steam from the locomotive will be passed through one heat exchanger at reduced pressure for the purpose of heating the water in the tank to a temperature of 180 F automatically controlled.—*From the November issue of Copper & Brass Bulletin. Published by Copper & Brass Research Association, 420 Lexington Ave., New York.*

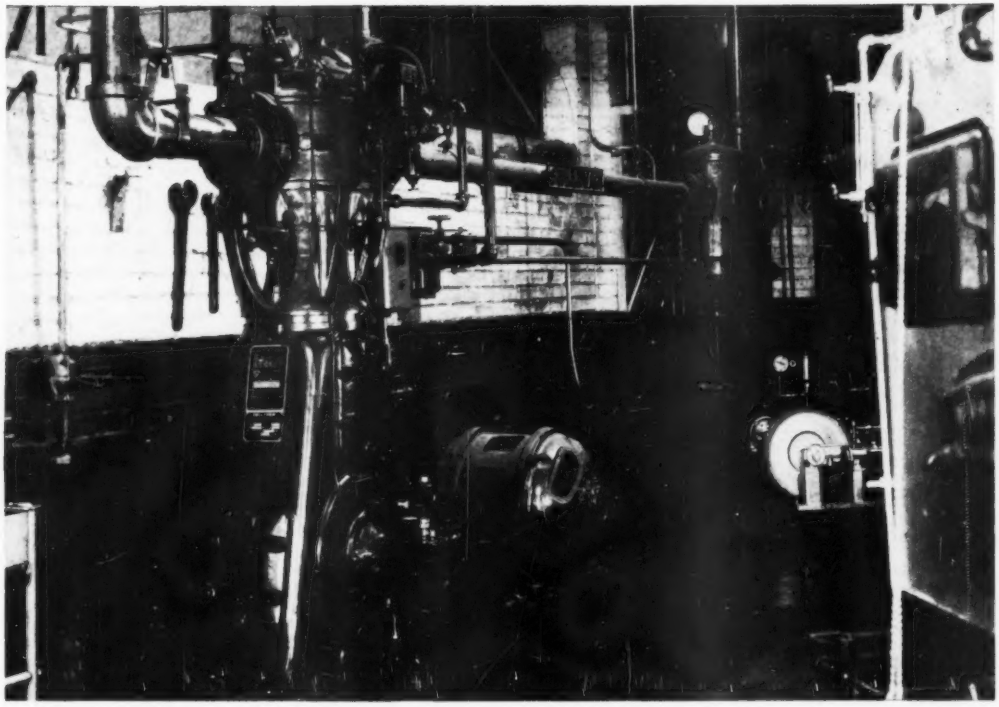
Alloys for Glass to Metal Seals

THE ART OF sealing metals to glass has been remarkably advanced since the early days of the electric light bulb in which platinum wire was used with a lead glass to form a glass-to-metal seal. In order to produce a satisfactory seal it is essential that the glass "wet" the metal and that the stresses resulting from the sealing operation do not exceed the strength of the glass. In order for glass to wet a metal surface it is necessary to provide a thin, continuous, adherent film of metal oxide. During the sealing operation the temperature is raised to a point where the oxide partially dissolves in the glass.

The degree of adherence is a function of the thickness of the oxide film and the duration of the heating cycle. For example, if the oxide film is too thin or the heating time prolonged, the glass will absorb practically all of the oxide resulting in a weak bond between metal and glass. An overoxidized metal surface will result in poor adhesion between the metal and metal oxide, a common cause of leaky tubes.

Allegheny 42 is extensively used in the manufacture of sealed beam automobile headlights, cast glass bushings for capacitors and in grommet and pin type seals employing a precast glass insert. It is also the core metal used in the manufacture of Dumet. This alloy has the lowest expansivity of the nickel iron alloys that are commonly used in glass sealing. The coefficient of expansion of Allegheny 4750 is higher than that of Allegheny 42 and it matches the expansion curve of soft glass quite closely.

Relatively strainfree seals can be attained with careful annealing practice. This composition is extensively used in the manufacture of electrical resistors in which 4750 terminal strips are sealed to a glazed ceramic. The most recent addition to the glass-to-metal sealing alloys manufactured by Allegheny Ludlum is Sealmet HC-4 a 42 per cent nickel iron alloy modified by the addition of 6 per cent chromium. This alloy, a development of Sylvania Electric Products Inc. had its original application in the form of wire for pins in the "lock-in" radio tube. *By John H. Crede in Steel Horizons, a publication of Allegheny Ludlum Steel Corp., Pittsburgh.*



SAVE VALUABLE SPACE WITH THE EFFICIENT

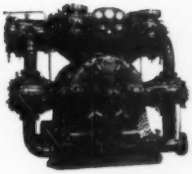
JOY WG-9 HEAVY DUTY AIR COMPRESSOR

The vertical design and small base of the JOY WG-9 Compressor mean great savings in valuable floor space. Built in eleven sizes from 153 to 822 CFM, the WG-9 is designed for continuous heavy-duty service... features the exclusive JOY "Dual-Cushion" valves for top efficiency and lowest-cost operation. ● JOY builds the most modern compressors available for either centralized or decentralized air supply—*write for Bulletin.*

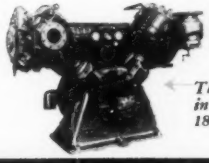
Consult a Joy Engineer

The JOY WL-80, in nine sizes from 81 to 590 CFM.

The JOY WN-114, in single or twin units from 1092 to 7312 CFM.



The JOY WN-112, in sizes from 378 to 1828 CFM.



W&D 1204A

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

Maintenance and Operation

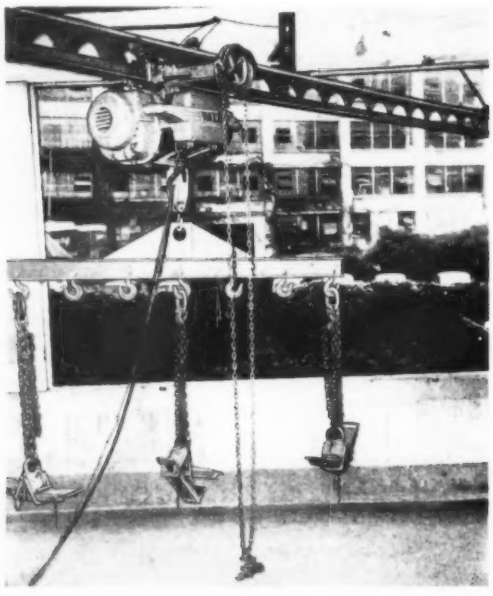
Over-The-Yard Hoist Saves Time

Contributed by Yale & Towne Mfg. Co.

EIGHT HOURS' work is now done in one at the Morse Chain Co., Ithaca, N. Y. This saving was effected when an electric trolley-hoist was mounted on an I-beam extending out over the plant yard. The hoist picks up sheet steel in the plant yard, hoists it to the third story, and carries it into the shop. A long electric cable permits the operator to control the raising and lowering of the load (by push-button control) when the hoist is at the far end of the beam. Thus, manual lifting and elevator transportation within the plant are eliminated. Also, a dozen or so sheets can now be handled at once whereas formerly the sheets were handled singly or a few at a time, depending on their size.

In addition to the hoist, a special pick-up device is used to further facilitate sheet-steel handling. Before the special pick-up device was installed, a chain was wrapped around the stacked sheets and the hoist hook attached to the chain. This caused the ends of the stack to droop when lifted, and deformed the steel as well as made it difficult to handle. The new yoke-like hoist hook attachment has three pairs of grips which grasp the sheets in three locations along each side of the stack and thereby holds the sheets stiff during hoisting operations. The elements which engage the sheets are adjustable so as to handle stacks of various numbers of sheets.

Ideas such as the one illustrated can save time and money for the user whenever forethought and skill are applied in planning the installation. The hoist application in this case is but one of a number of new cost cutting handling techniques recently put into effect at the Morse Chain Co.



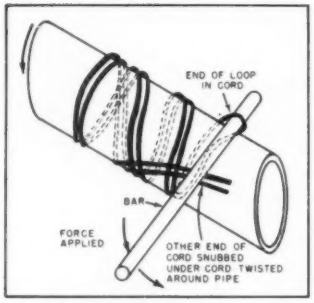
This photograph shows not only the over-the-yard rail upon which the hoist runs but also gives a good view of the special pick-up device which prevents deformation of the load of steel formerly caused when a chain was wrapped around the load and an end allowed to droop

When You Have No Pipe Wrench

Contributed by Morris Podell

MANY TIMES an engineer, maintenance man or mechanic is caught in the field without a pipe wrench and with a great need for one. The accompanying illustration shows a method which is old, but always useful. I have used this method for years on every type of job from taking a fishing rod apart to turning large diameter pipes. Any strong line—cord, rope or chain—can be used. It is especially useful on such objects as smooth tubing where a wrench might cause scoring or other damage.

Just lay the cord, rope or chain, doubled and with the loop at the head end, in a spiral fashion along the pipe or rod to be turned.



The cord is doubled, laid out lengthwise on the object to be turned and then doubled back on itself in a wrap-around. Make sure that the loop ends up at a point where the bar can be inserted

Then double it back on itself making certain that the force can be applied on the proper direction for loosening or tightening, depending on what is wanted. The sketch explains the method in detail.

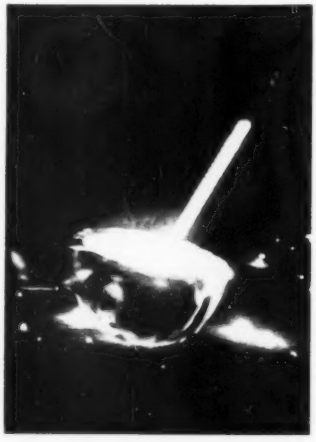
"Eye-Dropper" Method Of Testing Steel

Contributed by General Electric Co.

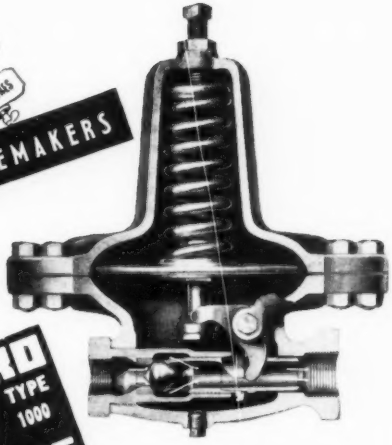
SCIENCE has removed the eye-dropper from the family medicine cabinet and put it to work sampling molten steel at 2700 F according to engineers of the General Electric Co.

The "eye-dropper," as now used industrially in the Schenectady Works Laboratory, is a heat-resist-

(Continued on page 16)



GET RID OF THESE TROUBLEMAKERS



Many Businesses Do by Installing the . . .

CASH STANDARD Streamlined PRESSURE REDUCING VALVE TYPE 1000

Check THE NUMBER BEFORE EACH OF THE FOLLOWING USER'S STATEMENTS AGAINST THE 10 POINTS LISTED

1. A manufacturer checks 6 of the points and says, "Installed the '1000' on our fuel burning equipment and HAS GIVEN ENTIRE SATISFACTION."

2. A chemical company checks 6 of the points and says. "We have operated two of your CASH STANDARD Streamlined Type '1000' Pressure Reducing Valves in our plant for eighteen months with NO MAINTENANCE OR ADJUSTMENT REQUIRED."

3. A lumber company checks 3 of the points and says, "We use this valve to REDUCE THE PRESSURE from our boilers to the office where we use this steam from the boilers to heat the office. We have USED THIS VALVE FIVE YEARS and it has NEVER GIVEN ANY TROUBLE."

4. A machine works checks 9 of the points and says, "We have had NO TROUBLE with the '1000' valves now in use on our preloading unit."

5. A laundry checks 7 of the points and says. "It is a GOOD TROUBLE-FREE, TIGHT CLOSING, COST-SAVING VALVE with PRACTICALLY NO MAINTENANCE."

6. A meter manufacturer checks 4 of the points and says, "Valve used in Research Dept. for VARIOUS TEST PRESSURES THAT MUST BE MAINTAINED regardless of upstream pressure changes."

7. A boiler and tank company checks 9 of the points and says. "We have in operation many CASH STANDARD Type '1000' Streamlined Valves and are pleased to state their PERFORMANCE HAS BEEN SATISFACTORY AT ALL TIMES."

1 2 5 7	**POINT No. 1** **Maximum capacity when needed most.**
1 2 4 6 7	**POINT No. 2** **Accurate pressure control under toughest working conditions.**
1 2 3 4 5 6 7	**POINT No. 3** **Trouble-free service.**
1 2 3 4 5 6 7	**POINT No. 4** **Smooth operation.**
1 2 4 5 7	**POINT No. 5** **Tight closure.**
4 5	**POINT No. 6** **Speedier production results.**
4 5 7	**POINT No. 7** **Elimination of failures.**
4 5 7	**POINT No. 8** **Cost-saving operation.**
4 5 7	**POINT No. 9** **No spoilage.**
1 2 3 6 7	**POINT No. 10** **Practically zero in maintenance.**

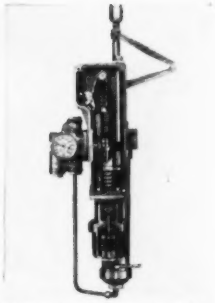
Send FOR BULLETIN 962

CASH STANDARD CONTROLS.. VALVES

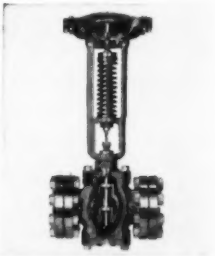
A. W. CASH COMPANY
DECATUR, ILLINOIS

BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES

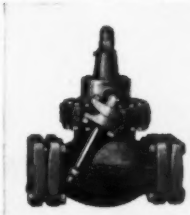
Send for them



Bulletin 963 features the CASH STANDARD Type 100 Series of Super-Sensitive Controllers — various types for automatically operating valves, dampers, rheostats, stokers, pulverizers, fans, and other apparatus. 16 pages filled with descriptions and applications.



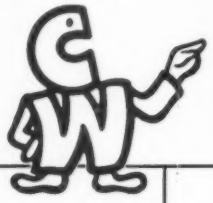
Bulletin 968 features the CASH STANDARD Type 34 Pressure Reducing Valve — direct operated — direct acting for handling steam, hot water, cold water, air, oil, brine—and most liquids and gases except some injurious chemicals. Illustrates and describes the different styles available and tells about their applications. Three pages of capacity charts.



Bulletin 956 features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.

It STAYS CLEANER LONGER....

See why the



C-W SEALEDPOWER

TOTALLY-ENCLOSED....FAN-COOLED MOTOR

SAVES 80% OF MAINTENANCE COSTS

COMPARE CLEANING COSTS!

	Conventional* Fan-Cooled Motor	VS	C-W Sealedpower Motor
	Normal (Not Extra Dirty) Service		
FREQUENCY	**EVERY YEAR** a conventional fan-cooled motor requires cleaning, in the opinion of experienced maintenance chiefs.		**ONCE EVERY 3 YEARS** is often enough for a Sealedpower motor, according to those who have had experience with it.
OPERATIONS REQUIRED	**17 OPERATIONS**—to shut down, dismantle, clean and reassemble motor. Motor must be shut down and taken out of production, for about 3 hours.		**NO NEED TO SHUT DOWN** in normal—not extra dirty—duty, no need to remove fan cowl, etc. Brushing cowl end, and cleaning outside of motor is sufficient.
TIME, LABOR COSTS	**$4.95** **3 HOURS** time, estimated by motor maintenance men, at union scale of $1.65 per hour, totals $4.95 yearly per motor, in normal service.		**14¢** **⅛ HOUR** time, once every 3 years, cleans a Sealedpower motor. At $1.65 per hour, cleaning cost per year is only 14¢.
COSTS IN ABNORMAL SERVICE	**EVERY 3 MONTHS,** a conventional motor, operating where dirt or lint is excessive, should be cleaned. That requires 18 hrs. of labor at $1.65, for a total cleaning cost of $29.70 per motor, during an interval of 18 months.		**ONLY ONE** cleaning every 18 months keeps a Sealedpower motor running cool and efficiently. Only ¼ hour to remove fan cowl, brush fan and outside of motor and replace cowl. A labor cost of only $1.24 per motor.

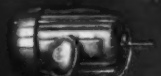
**A totally-enclosed, fan-cooled motor, of conventional design, was used for comparison*

You get this *dollar-saving design* only when you specify C-W Sealedpower Motors. No other totally-enclosed, fan-cooled motor has exterior cooling, with the fan-driven airstream blowing over the finned frame, carrying dust and fumes *outside* and *away*. It beats rust and corrosion, too, because the frame is rugged *cast iron*.

RATINGS FROM 3 TO 60 HP, horizontal or vertical, with NEMA "C" or "D" flange mountings. Many ratings are stocked . . . see C-W's weekly Stock Sheet. Talk over your motor needs with a Crocker-Wheeler representative.

FOR ANY APPLICATION WHERE EXCESSIVE MAINTENANCE IS INDICATED —*specify SEALEDPOWER and SAVE*

Protected-Type Motors



Sealedpower Motors

Wound Rotor Motors

Direct Current Motors

Generators

Flexible Couplings

It SKIPS SHUTDOWNS

150% MORE COOLING SURFACE is provided by the radiating fins, exclusive with the C-W SEALEDPOWER. Here, fluttering streamers trace the fan-driven airstream that blows dust and fumes outside and away.

CROCKER WHEELER

ELECTRIC MANUFACTURING COMPANY, AMPERE 3, N. J.

A Division of The Joshua Hendy Corporation

Branch Offices:
Boston, Buffalo, Chicago, Cincinnati, Cleveland, Los Angeles, Milwaukee, New York, Philadelphia, San Francisco, Pittsburgh, Washington, D. C. — Representatives in principal cities.

Before You Buy ANY totally-enclosed motor, be sure to read why SEALEDPOWER will prove a "maintenance miser" for you. This new booklet, "It's Different — it's a Dollar-saver," is packed with facts no savings-minded motor user can afford to overlook. Write for it.

Crocker-Wheeler Electric Mfg. Co.
Ampere 3, N. J.

Send the SEALEDPOWER Motor Booklet, *"It's Different — it's a Dollar-Saver"*.
PE-149

Name .....

Title or Function .....

Company .....

Address .....

(Continued from page 12)

ant glass tube, about the diameter of a lead pencil and 18 in. long, with a rubber bulb at one end. Liquid steel, fresh from the furnace, is drawn up into the tube by squeezing the rubber bulb, just as an eye-dropper draws up medicine. The steel hardens into a smooth, homogeneous rod within five minutes, the glass is cracked from it, and the rod is ready to be checked for quality.

Eye-dropper samples may be prepared for analysis in a few minutes. Older techniques required long hours and involved such laborious operations as cutting a block from a hardened steel mass, machining it into a rod, and buffing it to a high polish.

Three men, wearing gloves and goggles, form a highly coordinated testing team. In a sequence that must take no more than 60 seconds, the first man removes a puddle from the heart of the furnace with a ladle on the end of a ten foot pole. A second worker skins away the slag forming on the surface as the metal approaches the solidifying point. The third man then steps forward with the "eye-dropper" to suck up a glowing sample.

Cut in two and fitted into sockets before a spectrograph, the sample forms two electrodes of a high-voltage arc. An electric spark jumps between the two, giving off a light which varies with the makeup of the electrodes. By breaking up this light into its component colors with a prism, trained observers are able to judge the quality of any given batch sampled by the "eye-dropper."

Questions and Answers

Compressed Air System Leaks

IN THE November issue of PLANT ENGINEERING, F. N. B., Chicago, asked for help in checking a compressed air system for leaks without having to inspect every line, valve and nozzle throughout the plant.

Contributed by
Paul Wollner, Ch. E.

IF YOUR compressor is equipped with an automatic starter that cuts in at a certain minimum pressure all that is necessary is to connect an electric clock to the power line of your compressor so that the clock will stop and start together with the motor of the compressor; this will result in an indication of the running time of the compressor. The next step is to multiply the running time by the known capacity of the compressor during a certain period: e.g., an hour. This will give the approximate leakage in cubic feet of air during this period.

What Basis for Maintenance Budget?

Submitted by
D. P. M., Ft. Wayne

WE ARE PREPARING to set up budgets for the coming year for the maintenance of our boilers and machinery. We are interested in obtaining outside opinion as to what per cent of their value should be spent each year to properly maintain them. This information will give us a starting point for preparing our estimates. Can any of the other readers of PLANT ENGINEERING give us some help on this?

This question is being thrown wide open to every reader. It has always been a vexing problem and there are several answers. Following is one: It is frequently the practice to figure maintenance costs as a percentage of the total investment and include it in the fixed charges. Actually, there is little justification for this practice and carelessly used it may give erroneous results. A manufacturer of high grade equipment naturally needs to charge more than one whose equipment is not so well constructed. The high grade equipment should cost less to maintain than the less expensive equipment, yet an average percentage figure applied to each penalizes the high cost equipment. For instance, if your boilers costs $30,000 each and you were to apply a 10 per cent figure to an expensive boiler of this type it would result in a $3,000 maintenance budget figure. Whereas, if your next door neighbor had a $20,000 boiler and he applied the same 10 per cent figure he would come up with $2,000 as a yearly maintenance budget figure. In actuality, it probably would cost you less to maintain your boiler than it would your neighbor to maintain his less expensive piece of equipment capacity and accessories being equal.

It is evident, also, that the total annual maintenance cost for a unit operating continuously will be considerably in excess of the cost if the same unit were operating on a single daily shift or seasonal basis. For these reasons, the larger part of the maintenance cost will be proportional to the output in horse power, with a smaller portion fixed by the number and size of unit and nature of the installation.

In reality a perfect maintenance program presupposes that, disregarding obsolescence, the material is returned to its original condition after each repair or preventive maintenance schedule goes through. If this is true, and if your installation is several years old the best basis for maintenance cost budget figures would be an average of the amount spent, let us say, over the past five years for maintenance on the same units. The final figure would also be influenced by your method of accounting or bookkeeping. Do you charge maintenance labor against the maintenance budget figure? Is loss of productive time during which the boiler or boilers must be out of service chargeable to the same account?

How Should Water Tank Be Lined?

IN THE November issue of PLANT ENGINEERING, K. J. M., Detroit, requested information regarding the proper line for a hot water tank. The following two answers have been received.

Contributed by
B. E. Nordhielm, P.E.

IN REPLY to K. J. M.'s question I would like to suggest that he try a product which we have found to be satisfactory in cases of this type in our plant (Old Fort Division, Clearwater Finishing Co.). Pittsburgh Plate Glass Co. puts out a paint called Ironhide Metal Paint which does an excellent job. The tank surface should be thoroughly cleaned and primed with inhibitive red Ironhide. We have had considerable luck with this on the smaller steel tanks used for handling hot water.

Contributed by
C. E. Holder, P.E.

I THINK the following information may be of help to K. J. M. If we had such a problem in our plant (International Salt Company) we would first sand blast the tank and then metallize it with zinc. We formerly used this method to finish Lixator tanks in which salt was dissolved into full strength brine. The method was superceded by Lithgow enameling of the tanks but this method was used only because of its lower cost; Lithgow enameling requires baking and in many plants is not practical for tanks as large as 7 ft by 11 ft. Zinc is a good material to use in coating a water tank because it is not poisonous, it spreads well and is less porous than some others. About 12 passes would be required with a Metallizing gun.

Large number of boiler tubes for maximum heat transfer. Boiler manufacturing methods insure a maintenance-free, long life.

Four adjustable louvered discharge nozzles direct air at any vertical angle.

Beautifully styled, a credit to any shop.

Welded combustion chamber surrounded by a curtain of cool air, keeps outer wall cool.

Light weight (1200 lbs.) makes THERMOBLOC applicable to temporary installations.

Simple gun-type, pressure atomizing oil burner is standard. Interchangeable gas burner available. 82-86% efficiency on either type.

Three control devices make THERMOBLOC completely automatic.

High capacity, axial flow F.D. fan may be operated independently of burner for summer circulation.

Only 30" diameter floor area required for an output of 550,000 b.t.u.'s!

These floor plans illustrate method of one or more THERMOBLOC installations, depending on size of plant. By blanking off one or more outlets, it is possible to place the THERMOBLOC against the wall or even in a corner.

Look Inside

THERMOBLOC

DIRECT FIRED UNIT HEATER

for the answer to your space heating problem

The simplicity of THERMOBLOC design is an important factor in its outstanding success as a heating unit. Built to conform to boiler manufacturing standards, THERMOBLOC provides the most direct, efficient transfer of heat from the products of combustion to air.

Engineers with years of experience in power generation equipment designed THERMOBLOC. The desired operating characteristics were determined by a survey, made to ascertain the requirements of actual users of this type equipment.

Clip the coupon and mail it for your copy of Bulletin 300 on this latest and most efficient unit heater.

THERMOBLOC DIVISION

PRAT-DANIEL CORPORATION

72 Water St., E. Port Chester, Conn.

Thermobloc Division
PRAT DANIEL CORPORATION
72 Water St., E. Port Chester, Conn.

I would like to have further information on the New Thermobloc Unit Heater. My heating requirements are sq. ft. floor space.

NAME_____

COMPANY_____

ADDRESS_____

New Products and Methods

WHAT'S NEW? Here industrial ingenuity is summarized for your quick review. If you want additional information or have questions on specific applications use the addressed no-obligation, no-postage card between pages 18-19 and 58-59

1—Exhaust Snubber

Development of a new Terminal Exhaust Snubber has just been announced. It is for use on all four-stroke cycle Diesel and gas engines with relatively short exhaust systems in stationary and portable service and two-stroke cycle gas engine compressors operating on the Otto cycle in the petroleum field. Designated as Series SDT, these units are available in pipe sizes from 5 in. to 14 in. inclusive.

The new Terminal Exhaust Snubber combines the tail pipe with the exhaust Snubber and is intended for vertical mounting at the end of the exhaust

system. No additional tail pipe is required. The new Terminal Exhaust Snubber gives effective noise control by dissipating the slug's energy before it is released to atmosphere.

Engineered in the laboratory and tested in the field, these Snubbers prevent noise by smoothing the flow of exhaust gas. High restriction is avoided by offering maximum impedance to the high-velocity exhaust slug and minimum restrictions to the normal flow of exhaust gas. Burgess-Manning Co.

2—Soldering Flux

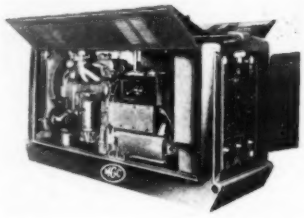
This new liquid aluminum soldering flux makes possible sweating on aluminum, stainless steel, monel, copper, brass, steel or any combinations of these metals.

This flux breaks the surface oxide on all types of aluminum so that a sweat job is possible. When used in combination with this company's All Metal Solder it is said to eliminate the electrolytic action between dissimilar metals so that a permanent bond, highly resistant to corrosion is obtained. Induction heaters as well as torch or iron can be used for heating mediums. This flux is $3.50 per pound. Farrelloy Company.

3—Engine Generators

MGC engine-generator sets are available in single or three phase, 50 or 60 cycle, and in sizes from 5 kw to 60 kw. Each set is self-contained and fully equipped with controls, radiator, fuel tank and weatherproof canopy.

These units are delivered factory-assembled and wired complete ready to put into service. The generators are of the revolving-field type with direct-connected exciter and built-in automatic voltage regulators which are designed to produce terminal voltage within 3 per cent at any load or power factor within the generator rating.



D-c generators are of the compound-wound interpole type and are available in any size, 5 kw through 60 kw. These generators are of the single ball bearing heavy-duty type and are directly connected to the engine by a flanged coupling.

Both types of generators up to 25 kw are available with gasoline engine, whereas units with 20 kw through 60 kw ratings have Diesel engines. They are designed for stationary, portable or standby service. Motor Generator Corp.

4—Smoke Tester

An addition to its line of smoke measuring instruments — a simplified, hand-operated True-Spot Smoke Tester, primarily for use in checking oil burners for clean firing has been announced by this company.

A smoke test is made with this tester by locking a paper test disc into the instrument, inserting the metal probe into a suitable hole in the smoke pipe, and drawing with six pump strokes a

sample of the combustion gases from the furnace flue.

Drawing the sample through the tester will turn the test disc to a shade of gray which will vary from light to dark depending upon the smokiness of the flame. The disc is then removed from the tester and the soot content of the gas sample is measured by comparing the discoloration of the disc with nine shadings on a "Scale of Soot" which is supplied with the instrument. The "Scale of Soot" tells the limits of permissible smoke for various burners and types of heating systems.

The handle of the instrument is designed to hold a supply of test discs, so that they are protected, and conveniently at hand.

The instrument lists at $16.00, complete with 100 test discs and smoke scale. Bacharach Industrial Instrument Co.

5—Giant Motor Crane

An advance in mobile equipment for handling heavy materials, which makes possible the lifting and transporting of extremely heavy loads is signalized by

announcement of a giant, rubber-tired, two-engined moto-crane, said to be the world's largest.

The development, designated the Lorain MC-820 Moto-Crane, has a safe-rated lifting capacity, on outriggers, of 45 t at a 12-ft radius.

By its ability to lift and transport much heavier loads the MC-820 Moto-Crane greatly extends the rubber-tired crane's basic advantages in heavy-duty crane service as, for example, in steel mills, steel erection, ship building, bridge building, logging, oil fields, and any other industries where the handling of heavy materials is an essential operation. Many applications are anticipated as industry gains experience with the new unit.

Weighing 65 tons, the new monster moto-crane has the following overall dimensions: length, with boom in travel position over front of carrier, 66 ft, 5 in.; width, outside to outside of tires, 11 ft, 7¾ in.; height with gantry erected 19 ft, 5 in., with gantry lowered 14 ft. Thew Shovel Co.

THIS PUMP HANDLES ARMOUR'S LIQUID SOAP

...and with less maintenance, too!

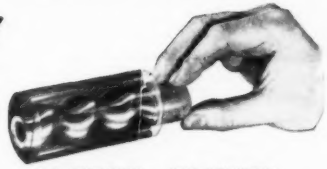
●"We cured a soap pumping headache with this Moyno," says A. Spence, Chief Development Engineer of Armour & Company's Inedible By-Products Division. "In addition, the Moyno saves considerably on power costs, and takes practically *no* maintenance."

24 HOURS A DAY

Armour's Type CDQ Moyno (tubular type, with hardened tool steel rotor and synthetic rubber stator) pumps alkaline liquid soap under constant pressure, at the rate of 12,000 pounds per hour, 24 hours a day, 5 days a week. It *made the process work* in Armour's granulated soap department.

MOYNOS MAKE TOUGH JOBS EASY

Armour's experience is typical. So if *you're* having pumping troubles, we suggest *you* call in a Moyno man, too. Chemicals and foods—abrasive slurries, viscous sludges—hot or cold—Moynos handle virtually *everything* from volatile liquids to non-pourable pastes. Types and sizes for all needs; distributors from coast to coast. Write *today*.



NO PISTONS • NO VALVES
NO HIGH-SPEED IMPELLERS

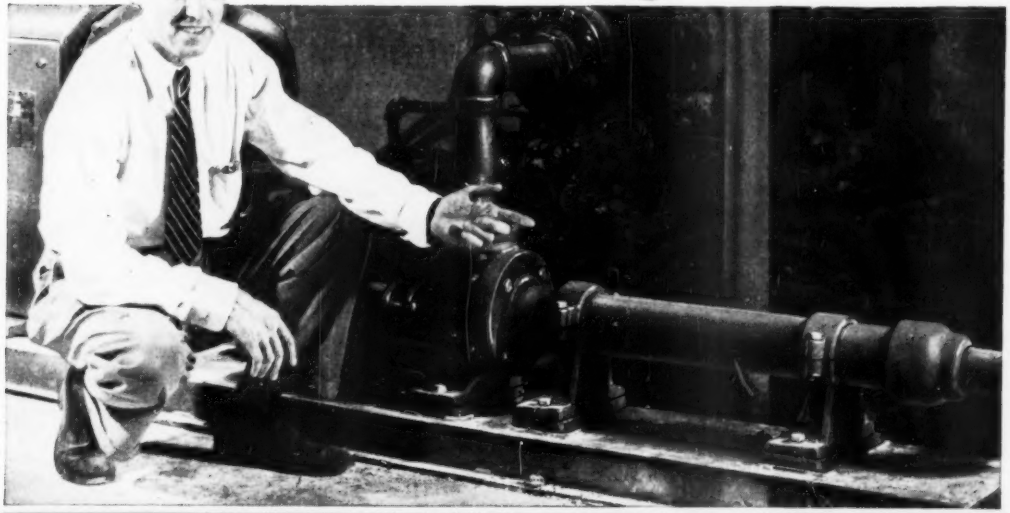
A helical rotor (the only moving part) turns in a double-helical stator; forms progressing cavities that pass particles and solids in suspension, resist chemicals and abrasives. Continuous, *ever-changing* seal lines prevent concentrated wear, make parts last longer. Moynos self-prime and reverse—meter flow—deliver positive, *non-pulsating* pressures to 1000 p.s.i.

R & M
MOYNO®
PROGRESSING-CAVITY
PUMP

FREE BOOK GIVES ANSWERS

"A Turn for the Better" explains progressing-cavity pumping; lists uses; gives types, sizes, and dimensions. Just ask for Book No. P-22E.

"This Moyno pump is just right," says A. Spence of Armour & Company.



ROBBINS & MYERS, INC. MOYNO PUMP DIVISION
Springfield 99, Ohio • Brantford, Ontario

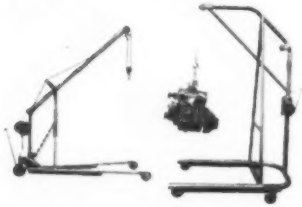
MOTORS • HOISTS • CRANES • FANS • MOYNO PUMPS • FOUNDED 1878

New Products and Methods

6—Portable Shop Cranes

Three new portable shop cranes have been announced. No. 1-C with a lift up to 7 ft and No. 2-C with a maximum lift of 10 ft 8 in. is guaranteed for 4000 lb lift but has been tested to 7000 lb without any fractures to the material or winch. No. 1-C weighs only 350 lb, No. 2-C 365 lb and No. 7-C 480 lb.

These new cranes are easy to roll anywhere. They are ideal for handling motors, engines, castings, etc. in and out of lathes and other machine tools, dies



in and out of punch presses, loading and unloading trucks and moving heavy items in and around the shop yard.

The safety winch crank is turned in clockwise direction to lift the load. Seven turns of the crank lifts the load approximately one foot. When operator stops to turn crank, the load is held in that position. Whenever operator stops, the load is held firm and safe. The winch is of sufficient strength to carry the maximum load on a single cable line with one man at the crank.

On Model 7-C the boom can be extended to 79 in. When folded down it is only 48 in. from the ground. It fits under 6 ft opening through 32 in. width doorway; moves on roller rubber tired wheels. Boom and winch weigh only 185 lb and may be removed from wheel carriage by removing one belt. No. 7-C may be supplied with hydraulic operation with extra reach and lift capacities. Grand Specialties Co.

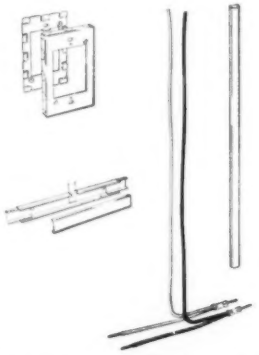
7—For Scraps, Forgings

New corrugated boxes for use with revolving head fork trucks are now being manufactured. The boxes are designed for the more efficient handling of scraps or forgings for dumping. Slots at two sides also make for convenience handling in dumping operations.

A construction feature is the square corners which give more interior box space. Design also permits conservations of floor space in stacking. Boxes are all-welded steel construction. They are manufactured to customer specifications. Palmer-Shile Co.

8—Take-Off Kit

The addition of a No. 200-19 Take-Off Kit for extending wiring from an existing wall outlet to a run of Plug-mold, wired or unwired, on top of baseboard, has been made to this company's line.



Consisting of an extension adapter, a 15 in. length of Wiremold, a reducing connector, and a wiring harness of No. 12 type R conductors, this kit—complete, in one package—provides all the necessary material to complete this connection, thereby making it possible easily, quickly, and neatly to make present electrical outlets without channeling into walls. The Wiremold Co.

9—Hi Speed Lift Truck

A gasoline powered fork lift truck of unusual design simplicity is now being manufactured. Its 1000 and 2000 lb lift capacity makes possible high speed loading and unloading of highway

transport trucks and railroad cars. Full pneumatic tires allow fast travel on bumpy and uneven road or platform surfaces.

Unique design features include: All welded one piece body frame construction of heavy gage steel stampings; four cylinder water cooled fabricated engine developing 26 hp; 61 in. turning radius for maneuverability in narrow-aisle, congested warehouses; hydraulically operated lift and tilt of load-carrying mast.

Do you want more information on this equipment and its application? Use the no obligation, no postage card between 18-19 and 58-59

Most unusual is the Hydroflex clutch, which deviates entirely from the conventional by being located behind and above the engine for easy accessibility. Operated hydraulically, the Hydroflex clutch can be adjusted or completely changed in 15 min.

Movement of hands or feet to reach controls has been minimized by automotive type grouping. Operator fatigue is lessened by form-fitting seat placed in automotive position.

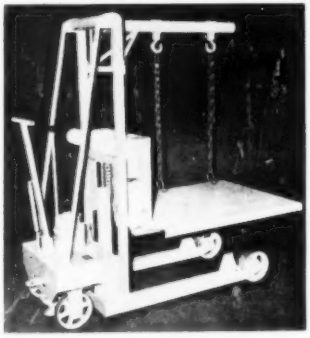
Total weight of the 1-t capacity Transitier is approximately 3000 lb and both models are available in 5, 7 and 9-ft lift heights. Transitier Truck Co.

10—Die Handling Truck

The company's standard Hydraulic High Lift Truck, designed to handle 3000 lb loads, is now furnished with boom and chains for die separating. The boom extends 36 in. and the hooks are fastened to sliding rings so that large or small dies can be handled on the 30 in. by 36 in. platform.

Easy elevation is made possible by a heavy duty two speed hydraulic hand pump. A winch with 15 ft of steel cable is provided for drawing the dies from presses to the truck platform.

Stability is provided by the auto steer arrangement on the front wheels, and



the truck can be locked in position by a brake which engages the floor.

The platform has a range of elevation from 6 in. to 54 in. and, since the boom can be removed easily, the equipment adapts itself to stacking, tiering and for many other handling problems.

The unique welded tubular and formed steel construction provides maximum strength without unnecessary weight. The truck weighs approximately 1100 lb and has an overall height of 83 in. This equipment is also offered in 1000 and 2000 lb capacities. Lyon-Raymond Corp.

11—Condensation Pump

An entirely new, compact, low price condensation pump with several improved engineering features has just been developed. Known as the 4100

Any V-BELT Changes Shape *when it Bends*

Prove this yourself!

That's Why the CONCAVE SIDE...

(U. S. PATENT NO. 1813698)

The Mark of SPECIALIZED Research

Gives You 2 Big SAVINGS!

Bend *any* V-Belt and *f e e l* it change shape. The top, under tension, *narrows*. The body, under compression, *widens*. The sides of the belt bulge out.*

Straight-Sided V-Belt

Straight-Sided V-Belt Bulges in Sheave-Groove.

The result, if the belt is built with *straight* sides, is a shape that does not fit the sheave groove — as shown in Figures 1 and 1-A, above.

Now, bend the V-Belt built with the precisely engineered Concave Side (U. S. Patent No. 1813698) — the Gates Vulco Rope.

Gates Vulco Rope With Concave Side.

No Side Bulge. Precise Fit in Sheave Groove.

You get the same shape change but *now* the new shape *exactly fits* the sheave groove as shown in Figures 2 and 2-A.

Results— (1) *Uniform* side-wall wear; *longer* life. (2) *Full* side-wall grip on the pulley; carries heavier loads and sudden load increases without slippage—a big increase in drive efficiency—saving belt wear a n d also saving power!

The Concave Side is MORE IMPORTANT NOW Than Ever Before

Because the *sides* of a V-Belt are what actually *drive* the pulley, it is clear that any increased load on the belt means a heavier load that must be transmitted to the pulley *directly* through the belt's side-walls.

Now that Gates *SPECIALIZED* Research has m a d e available to you SUPER Vulco Ropes—carrying fully 40% higher horsepower ratings—the life-prolonging Concave Side naturally delivers greater savings today than ever before.

4812

GATES VULCO ROPE DRIVES

Engineering Offices and Jobber Stocks IN ALL INDUSTRIAL CENTERS of the U. S. and 71 Foreign Countries

THE GATES RUBBER COMPANY
DENVER, U.S.A.
"The World's Largest Makers of V-Belts"

New Products and Methods

Series Condensation Pump, the new unit has a wide capacity range that solves the problem of stocking various sizes. It is conservatively rated to handle any capacity up to 6000 sq ft edr, against a discharge pressure up to 20 lb. The new unit is exceptionally neat and compact—free from external piping, angle iron supports, and irregular surfaces.

All parts such as the motor, pump, float switch, and drain plug are easily accessible from the front for quick inspection and fast servicing. Simply by removing four cap screws, the entire motor and impeller assembly may be lifted from the pump housing without disconnecting piping. Disassembly of the unit is accomplished without prying or hammering, only two hex keys and an open end wrench being required.

The two-piece construction of the bronze impeller has been designed specifically for this unit. Such design assures very smooth surfaces within the impeller passages to handle condensate

with the greatest efficiency in relation to pump size. The impeller, in addition, is fitted with an oversize carbon type rotary seal which will give thousands of trouble free hours under normal operating conditions. Since this seal runs on the impeller hub, the motor shaft is not exposed to corrosion by condensate. There is no packing which can be over-tightened. The capacitor-start ¼ hp dual voltage motor is dynamically balanced for quiet operation. Vertical mounting above the pump, together with drip-proof enclosure, protects it from moisture. Conservative rating assures that no pressure variation can load the motor beyond its safe horsepower rating. Condensate, is collected in a heavy 15-gal steel tank. A built-in strainer protects the pump from clogging. Levels are controlled with a non-corroding float set to a dependable single pole float switch. Sterling, Inc.

12—Electrical Insulation

An entirely new type of electrical insulation has been produced. Called "Quinterra," the product is the result of eight years of study and experiment. Quinterra is a completely inorganic, asbestos-base insulation possessing properties of thinness and electrical insulating strength never before attained in a flexible, inorganic asbestos sheet. In appearance Quinterra resembles paper and is furnished in long lengths in roll or tape form. Quinterra is of closed structure, and has no holes or interstices. It is of particular interest as an electrical insulation where high temperatures are encountered since tests demonstrate that it retains its high dielectric strength of well over 250 vpm even at elevated temperatures. Manufactured by a special paper making process it can be varied from a tissue-thin 1.5 mil to 20 mils in thickness. Johns-Manville officials explained that initial manufacturing will be in thin sheet form for electrical wire insulation and slightly heavier for layer insulation. Future plans call for the manufacture of a variety of thicknesses and laminates for other electrical insulating purposes. Johns-Manville.

13—Air Compressor

A vertical air compressor that is outstanding for the floor space it saves the user has been announced. The space saving feature has been developed by designing the unit with the tank upright and the motor and air compressor unit mounted on top. Three models have been developed. They are: the model 25-v, which has a twenty gallon tank with a 1½ cu ft per minute air displacement; the model 50-v which has a 30 gal tank and displaces 2.7 cu ft of air per minute; and the model 75-v

with a thirty gallon tank that displaces 4.07 cu ft of air per minute.

The model 25-v requires only 20 in. diameter of floor space and the other two models require only 24 in. diameter. All three units are equipped with a single phase motor that operates on either 110 or 220 v. The model 25-v has a ¼ hp motor, the 50-v a ½ hp motor, and the 75-v a ¾ hp motor. These compressors are made from high quality steel with electric welded construction. They have withstood a 400 lb hydrastatic test and have a 200 lb working pressure. Each is equipped with an automatic pop off valve and adjustable automatic switch. Grimes Co.

14—Battery Charger

A new automatic single-circuit motor-generator battery charger for motive power batteries, known as the "Charg-O-Matic," has just been announced. It is furnished as a complete package unit, occupies less than 4 sq ft of floor space, and is portable.

With all electrical connections, relays and other working parts mounted on a panel inside a metal cabinet, in which the horizontal motor generator is housed, the outfit is of the "dead front" type, to prevent accidental contact with electrical equipment. The control panel

is set at an angle at desk-top level, providing easy reading and convenient operation. A pilot indicates when the set is on charge.

The Charg-O-Matic replaces the Model H battery chargers long manufactured by this company. It will charge a lead-acid battery in 8 hr; a nickel-alkaline battery in 7 hr, and meets the specifications of the Electrical Industrial Truck Association and the recommendations of battery manufacturers. The Hertner Electric Co.

15—Valve Refacer

A new "99" Valve Refacer, a streamlined basic model of the widely accepted Thor refacer line, designed for precision, wet grinding, has been announced. The new refacer is equipped with a double-grip collet and new speed chuck for fast, precision valve refacing at all standard angles.

Extra heavy construction, automatic bearing compensation at critical points of wear. Sliding heads feature smooth-riding three-point suspension on hardened and ground slide rods. Double-grip collet is hardened, ground and internally lapped, gear driven by its own individual motor. New speed chuck permits even large butt-end valves to be admitted and released with only one turn of the new 2¼ in. hand wheel. Independent Pneumatic Tool Co.

15A—Anchor, Drill Kit

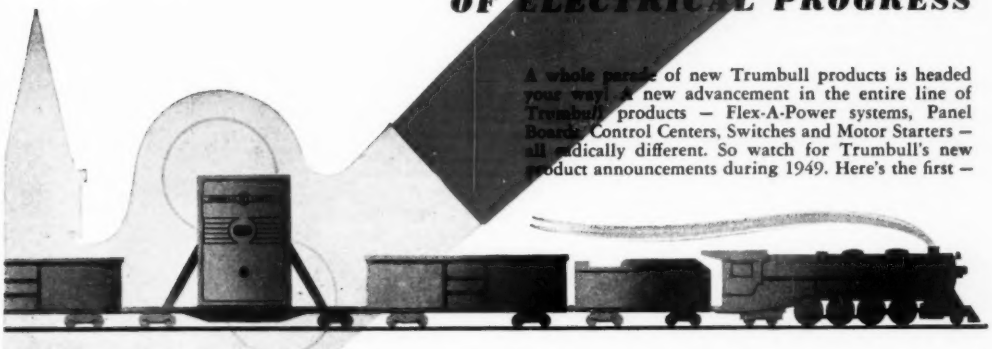
To help simplify screw anchoring problems—Sand Scott plastic expanding Screw Anchors are now available in an Assortment Kit, along with 3 carbide tipped masonry drills. This new combination kit offers extreme flexibility on all anchoring jobs since the anchors are universal for mounting screws into any and all materials such as: plaster, concrete, brick, tile, glass, sheet rock, etc. The Holub drills are also universal for drilling all materials and especially designed for use with hard materials such as: concrete, tile, brick, marble, etc. They can be used with electric or breast drills and clean holes are drilled in 30 seconds. This unique development greatly speeds up screw anchoring installation, assures tremendous holding power, neater work and much lower cost. Holub Industries, Inc.

HERE COMES THE

Trumbull Train

OF ELECTRICAL PROGRESS

A whole parade of new Trumbull products is headed your way! A new advancement in the entire line of Trumbull products — Flex-A-Power systems, Panel Boards, Control Centers, Switches and Motor Starters — all radically different. So watch for Trumbull's new product announcements during 1949. Here's the first —



A NEW

Magnetic Motor Starter and Magnetic Contactor

New, from top to bottom, Trumbull Starters and Contactors in sizes 0, 1, 2, 3 give maximum protection to motors up to 50 hp, 440 v. Look at all their important new advantages:

LONGER CONTACT LIFE —
Actual factory tests show the silver contacts on the Trumbull starter "make and break" for millions of operations — many times more than any starter on the market.

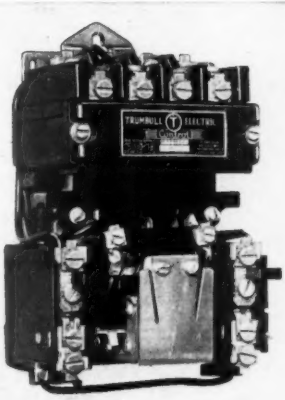
EASY TO MAINTAIN —
Silver contacts have permanently attached springs that are easy to remove. Terminals are located on the front and are easy to wire — a screw driver is all you need to disassemble starter — can be accomplished in less than a minute.

EASY TO INSTALL AND SERVICE —
Note convenient knockouts, large terminals, front connections, and ample wiring space.

GREATER PROTECTION —
Bi-metallic relay heaters follow motor's heating curve. Easily adjusted for automatic or manual reset.

BUILT TO LAST —
All parts resist corrosion and moisture. Examine plastic coil enclosure to see how the tough varnish impregnation protects windings. Contact points and cold-molded asbestos arc hood eliminate arcing . . . give clean "make and break" contact.

QUIET OPERATION —
Permanent lubricant impregnated in the plastic coil enclosure keeps magnet guides sliding smoothly . . . eliminates low voltage "chatter."



FOR MORE INFORMATION about this latest Trumbull development, write for Circular TEC 11. THE TRUMBULL ELECTRIC MANUFACTURING CO., Plainville, Conn. Other factories and offices throughout the United States. Foreign representation.

Men Who Observe the Best Electrical Practice Make It a Practice to Use

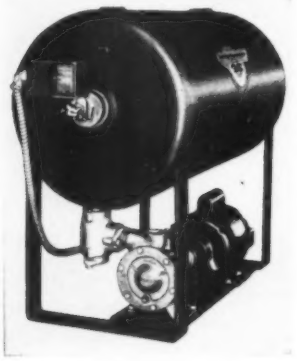
TRUMBULL (T) ELECTRIC

TRUMBULL'S TRAINLOAD OF NEW PRODUCTS

New Products and Methods

16—Condensate Return

A new "Packaged" Condensate Return Unit, the Type UA, which features simple construction and compact assembly, has been announced. Designed for use with heating systems in small office buildings, and small industrial plants, this 20 gallon unit returns condensate to the boiler at

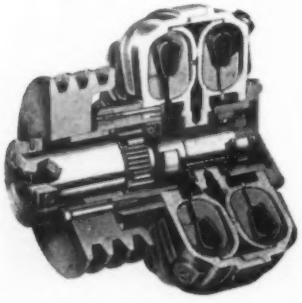


high temperatures insuring quick and steady heat and minimizing heat and fuel losses. The Type UA unit is completely automatic and includes pump, motor, receiver tank, float switch, a strainer, piping, and base in the assembly, which requires only 5 sq ft of floor space. The pump employed is the turbine type and is equipped with bronze liners and impeller to resist corrosion. Roy E. Roth Co.

17—Hydraulic Drive

The New Hydro-Sheave Drive is a hydraulic-conversion device for small electric motors and internal combustion engines. The basis of the new unit is a small hydraulic coupling, long successful in smothering shocks and smoothing the flow of power from motors or engines in the ¾ to 25 hp range. Designed especially for use with Worthington QD (quick detachable) V-belt Sheaves, the new Hydro-Sheave Drive package consists of a small hydraulic coupling, with a sleeved shaft which slides directly over the output shaft of any small electric motor or engine.

In this drive, oil is the only medium of power transmission. Incoming power from the electric motor or internal combustion engine rotates the hydraulic coupling inner member, the blades of which throw a continuous stream of oil against the vanes of the coupling outer member, or housing. The rotation of the housing with its attached sheave or sprocket provides a steady, uninterrupted flow of power to the driven equipment. A sudden shock, or overload, from the driven equipment is absorbed by the fluid in the hydraulic coupling and never reaches the motor or engine. Conversely, torsional vibrations from the engine or motor are effectively dampened out by the fluid and never reach the driven equipment.



Among the many industrial applications to which the drive may be applied are cranes, hoists, conveyors, elevators, winches, fans, blowers, compressors, machine tools, test stands, and on equipment in the rubber, textile, metal, paper and food industries. Features include: 1. Frequently permits the operator to choose a motor or engine on the basis of the running load, rather than on the basis of the starting load. 2. Allows the user either to employ his existing motor or a smaller motor or engine. 3. Reduces installation length by cutting out the necessity for outboard bearings and flexible couplings. 4. Can be installed as easily as a sheave alone. 5. May be installed either on the motor shaft or the primary shaft of the driven equipment, whichever is most suitable.

In short, the Hydro-Sheave Drive offers the operator all of the advantages of hydraulic coupling operation, such as no stalling, non-transmission of shock loads, smooth and rapid acceleration, plus the advantages of smaller motors, minimum space requirements and easy installation. Twin-Disc Clutch Co.

18—High Temp. Motor

Silicone resins for winding insulation and silicone grease for bearing lubrication make possible a totally-enclosed non-ventilated motor in a 5-hp 4-pole rating in the same frame sizes as the open motor of the same rating. This permits reductions of as much as three frame sizes from present standard Class A insulated totally-enclosed motors. The efficiency, power factor and torque of such a motor are comparable to those for an open motor of the same rating.

The accompanying photograph illustrates this size reduction possible through the use of Silicones. The motor on the left is

a Westinghouse 5-hp, 1750-rpm, 4-pole, Silicone insulated all steel Life-Line motor in the 254-frame; the one on the right is rated the same but is Class A insulated and is in a 326-frame. The weight by using Silicone is reduced from 250-lb to 145-lb, or is 60 per cent of the Class A insulated motor. Height is reduced 3-¼-in.; length, 7-¼-in.

This reduction in size and weight is possible by designing to take full advantage of the higher permissible temperature of Silicone insulation. Such designs make possible the opening of new fields in motor applications where space is at a premium. Westinghouse Elec. Corp.

19—Paint Brush Safe

A sealed, air-tight, all-aluminum container designed to suspend paint brushes at the correct depth in individual compartments holding paint solvent or preserving fluid, has just been announced.

This Brush Safe, states the manufacturer, not only preserves paint brushes and keeps them in tip-top shape, but it also makes a compact, lightweight carrying case which can be locked to avoid tampering and theft. Brush Safe has special waste-compartment with wringer attachment which extracts surplus paint or preserving fluid. Waste compartment is removable for draining and cleaning; and can be placed in any position within the Brush Safe. Movable brush clips

Do you want more information on this equipment and its application? Use the no obligation, no postage card between 18-19 and 58-59

in the individual storage compartments permit storage of brushes of varying dimensions. Each storage compartment is removable.

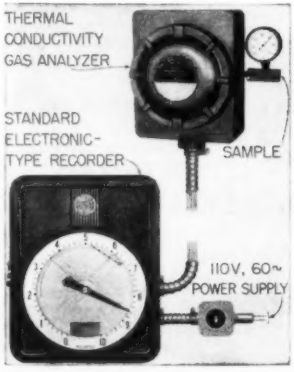
The Brush Safe is said to do away with the mess and drudgery of brush cleaning. In use, it has been found to be a worthwhile time-saver; and the manufacturer claims that the cost of the paint brushes can be repaid in short order thru the safe-care and extended life of the paint brushes used. The all-metal construction and tight-sealing lid reduces fire hazard. Yenne & North Mfg. Co.

20—Gas Analyzer

This company has recently expanded its line of automatic gas analyzers and recorders to include a thermal-conductivity type gas analyzer. The analyzer works on the standard principle of thermal-conductivity gas analysis which measures the rate at which heat is conducted by the gas being sampled.

The new analyzer is mounted in an explosion-proof case and is unaffected by voltage variations, ambient temperature, and variations in sample pressure. An all a-c circuit is employed, permitting the use of a standard Bailey Electronic Recorder which does not require dry batteries or a standard cell. The new analyzer is said to be unusually stable, fast in response, and requires no manual attention or adjustment except for routine maintenance.

The measuring circuit employs an a-c



Do you know how the new Metallizing method can help you slash repair costs?

Knowing the right answers to these questions might help you cut repair costs very substantially.

Question *Will metallizing give me a good job every time?*

Answer—Yes. Previously, when preparation for metallizing involved *seven* separate steps, a slip-up in any one step could result in a poor job. But now, Metco's new Sprabond enormously simplifies preparation. You spray this new self-bonding material directly on smooth steel and many other materials with no preparation beyond thorough cleaning. You get a perfect bonding surface. You get a good job every time.

Cut-away view showing typical build-up over Sprabond preparation coat on steel shaft section. With Sprabond, dovetailing of the coating is often unnecessary and the metallized build-up may be brought to a feather edge.

Question *Where does metallizing pay off?*

Answer—It's ideal for the repair of worn machine parts. It is not recommended for use on parts subject to severe impact (dies, punches, etc.); point stress (ball bearings, etc.); or elongation (gear teeth, threads, etc.). *But it will cut repair costs as much as 90%* on parts such as pump shafts, crankshafts, motor shafts, turbine shafts, transmission and worm shafts, spindles, lathe beds, pump plungers, impeller shafts and many others. Also good for fast, economical repair of cracked engine blocks, heads, casting defects, permanent molds, patterns, etc.; thin sections which would be distorted by other methods; strongly bonded coatings on aluminum and magnesium.

Question *How fast is metallizing?*

Answer—Modern metallizing guns deposit as much as 20 lbs. of steel per hour. With the new Sprabond process, you can put repaired parts back in service, often in a matter of minutes, instead of hours or days.

Just 3 Fast Steps in Restoring Worn Crankshaft Throws

1. Rough, cleaning cut taken and Sprabond preparation coat applied. 2. Throw metallized with .80 carbon steel. 3. Throw finished to original dimension.

Question *What other advantages has metallizing?*

Answer—Special long-wearing and corrosion-resistant coatings can be applied to inexpensive base metals. Microscopic pores in the surface of the metallized coat form tiny oil reservoirs that improve lubrication, usually outwear virgin metal. Low heat generated (150° to 250° F) eliminates danger of distortion. Metallized surface is smoother, requires less finishing, wastes less metal than other methods of metal build-up; choice of 32 different metals available in wire form.

Question *Is metallizing installation expensive?*

Answer—No. Metco's four gun models, ranging from the heavy-duty Type "Y," down to the new light-duty Type "L," which operates on 10 cubic feet of air per minute (3 hp compressor), permit choice of installation to fit a plant of practically any size. The original equipment cost is often recovered in the savings of time and material on just one or two important repair jobs.

Do you have some questions on metallizing that have not been answered here, or a special problem in machine repair? We will be happy to send further information, or have a Metco Engineer call in person. No obligation, of course.

FREE BOOKLET

METALLIZING ENGINEERING CO., INC.
38-13 30th Street, Long Island City, 1, N.Y.

Please send free booklet—"Metallizing Saves Money."

NAME _____ TITLE _____

COMPANY _____

STREET _____

CITY _____ ZONE _____ STATE _____

METALLIZING ENGINEERING CO., INC.
38-13 30TH STREET — METCO — LONG ISLAND CITY 1, N. Y.

New Products and Methods

potentiometer which operates on the null balance principle. The voltage drop across the sample cell of the analyzer is automatically balanced against the voltage drop across a motor-driven slidewire unit in the recorder. The recording pen is connected to the slidewire unit and any unbalance repositions the pen to record in terms of the factor being measured.

The recorder employs the use of electron tubes instead of a galvanometer so there are no continuously moving or vibrating parts. Two records of thermal-conductivity can be placed on the same 12-in. diameter uniformly graduated chart or one record may be combined with another of flow, pressure, temperature or some other related factor. Bailey Meter Co.

21—New Extinguishers

A complete new line of 2½ gal resistance Welded Silicon Bronze fire extinguishers to replace riveted and copper fabricated units of the same capacity. They are Soda-Acid; Foam; plain Water; and Anti-freeze Water types.

Each lighter in weight by 4½ lb, the manufacturer claims them to be much stronger because the materials used have higher tensile strength, are more smartly styled, and are enhanced in appearance by the golden-hued color of the highly polished Silicon Bronze.

Additional features include resistance welded seams; welded hemispherical domes, tops and bottom; silver soldered elbow pads; protection welded hanger loop; new wider bottom handle; interchangeable caps, collars and gaskets; new spot welded name plates with identifying colors for each type unit; transparent plastic nozzle providing clear vision of passageway and greater resistance to accidental blows which could close passage of ordinary lead nozzles. American-LaFrance-Foamite Corp.

22—Insulation Clip

A new, quick-drive fastening, known as the Lexsuco Insulation Clip, designed to attach insulation to sheet metal has been announced. The clip consists of a sharply pointed, hardened and tempered steel shank with a flat head as shown in the illustration. The slightly rounded shank provides strength for driving. The two shoulders prevent penetration beyond the thickness of the insulation and the special lock, stamped into the shank, locks the clip securely in place. The pointed shank will penetrate any metal thickness up to 18 ga. Of particular importance is the fact that no special tools or equipment are required for use with the clips. All that is necessary is an ordinary hammer. Further, the cost of the clip, as demonstrated in a number of applications, is below that of simplex nails, drive screws, etc., as the cost is exactly in line, and substantial time saving is effected through the fact that no boring of either sheet metal or tin caps is required and application is several times faster.

Lexsuco clips are practical on both exterior and interior work. In the application of insulation to steel roof deck, practice

has demonstrated that only 4 clips are required to hold a 2 ft by 4 ft sheet firmly in place instead of the six nails or drive screws ordinarily used.

For interior work the clips have proved highly effective in speeding up the application of insulation to duct work, warm air furnaces, etc. Use of the clips eliminates the necessity for pre-fastening insulation sheets by wiring or other methods commonly used. With these clips it is possible for the mechanic to place and fasten the sheet in a single operation. Procedure is to hold the sheet in place on the duct, place clips by pushing them into insulation and then drive clips home with a hammer without removing sheet from place. The work is thus speeded up and a substantial slice cut from application time and costs. Lexington Supply Co.

Bulletins . . . . Catalogs

ELECTRICAL

101 Building Wires, Cables—The electrical wire and cable department of this company has just published a 20 page catalog describing its line of latex insulated building wires and cables. The booklet gives performance characteristics, details of construction and specifications for the company's full line of armored cables, service entrance cables, non-metallic sheathed cables and its new building wire designed specifically for use in wet locations. United States Rubber Company.

102 For Industrial Signalling—This new folder describes a new annunciator for industrial and public utility signalling purposes. Complete operating information covering two types of annunciators is presented together with schematic wiring diagrams of both types. Dimensional drawings are also shown. The Autocall Co.

103 Electrical Alarms, Signals—This is a collection of bulletins which includes engineering data such as "How to Select Signals," information on industrial electric bells, horns and various other types of signalling devices. In practically every case, specifications are complete and prices are listed. The bulletins are well illustrated. Federal Enterprises, Inc.

104 Safety Device That Increases Production—This Bulletin 51 describes a safety device that increases production by lessening fatigue. The bulletin shows how the switch, a safety device for actuating power presses, can be used on punch presses, high speed riveting machines, or air cylinder types of spot welding machines. A brief description of the switch also is included. The switch, called Microtrip, is a new electrical device for two-hand operation. It can be used on practically any power operated equipment such as the machines mentioned above and on air presses and similar machinery. Micro Switch.

105 Tubular Rheostats Bulletin—Bulletin 41 just released by this company describes the various styles of standard, screw drive, double, graded, switchboard, metal-caged and non-inductive rheostats. There is a section on "How to Select" which shows diagrams and examples for the various applications of rheostats. The temperature rise and dissipating characteristics of these rheostats are discussed. Furthermore, charts are shown and examples given as assistance in the proper selection of these instruments. James G. Biddle Co.

106 Load Center Unit Sub-stations—How this company's new standardized load center unit sub-stations pay off in power savings, better performance, greater safety and flexibility, easy installation and quick delivery is told in this new 16 page Bulletin 11B6285A. The bulletin includes a simple and flexible nomogram which makes it easy to select the correct air circuit breaker for any application of a standardized load center unit sub-station. Sizes and dimensions of load center unit sub-station transformers, vertical lift metal-clad switchgear and Type L switchgear with air circuit breakers together with space requirements of standard low voltage switchgear are given. Copies of this booklet titled "How Power at Load Centers Pays Off" point out that transformers and metal-clad switchgear are not the only pieces of electrical equipment that can be packaged to save space and money and to provide better appearance and greater safety. Allis-Chalmers Mfg. Co.

BUILDINGS and MAINTENANCE

107 Metallizing Meter Units—To assure maximum efficiency with proper flame balance, higher spraying speeds and gas savings in the operation of metallizing guns is the purpose of this recently-announced Gas Flow Meter Unit described in a new bulletin. It is pointed out that the Gas Flow Meter Unit removes the human element from flame balancing. Features described include: Enables operator to adjust the gas balance so that it is exactly right for each metal; indicates immediately any restriction in gas flow or change in pressure; reduces cost per pound of metal sprayed by providing positive adjustment to most efficient flame; plus several other advantages. Metallizing Engineering Co., Inc.

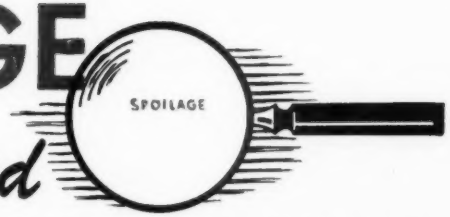
108 Concrete Floors Q & A—A new booklet titled "Lumnite Concrete Floors—Corrosion Resistant and Heat Resistant," has just been published. The detailed information contained in this booklet brings up to date the service experiences and late developments in this field. The information covers methods and materials used in placing corrosion resistant concrete in a wide variety of industrial applications. Typical uses of corrosion resistant concrete are listed for many industries and also given are the answers to a number of questions often asked about it. A section on placing and finishing corrosion resistant floors will be helpful to prospective users. Lumnite Division, Universal Atlas Cement Company.

109 Maintenance Ladders, Lifters—This excellent Bulletin 940B, which contains 32 pages, describes the many maintenance and lifting items in the company's line. The Bulletin is filled with photographs showing actual on-the-job uses of the various products. For instance the many applications of the telescopers for use in various overhead maintenance jobs are shown by a series of eight excellent photographs which cover the range of uses from servicing lights in a broadcasting studio to overhead maintenance in an industrial plant. Use of hand power lifters and electric power lifters for many jobs in and about the plant and warehouse are covered in similar manner. Other items described include barrel dumpers, trailer loads, lifters for unequal floor levels, balcony lifters, and many others. Economy Engineering Company.

110 Safety Walk Bulletins—These two 4 page bulletins describe the company's new safety walk, a coating which can be

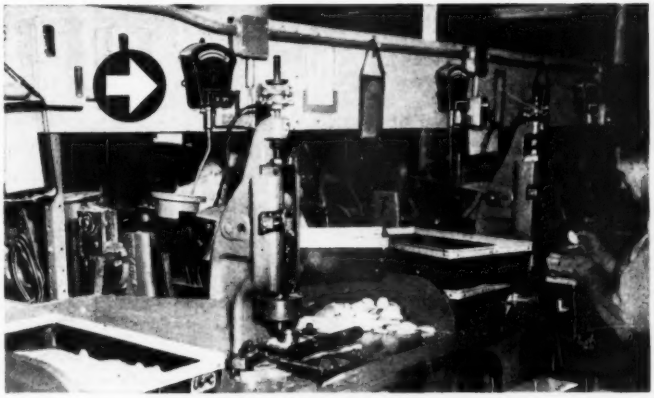
Mark the numbers of the bulletins you wish to receive on the no obligation, no postage card between Pages 18 and 19 and 58 and 59

SPOILAGE *Reduced*



LESS HEAT USED—MORE AND BETTER PRODUCTION

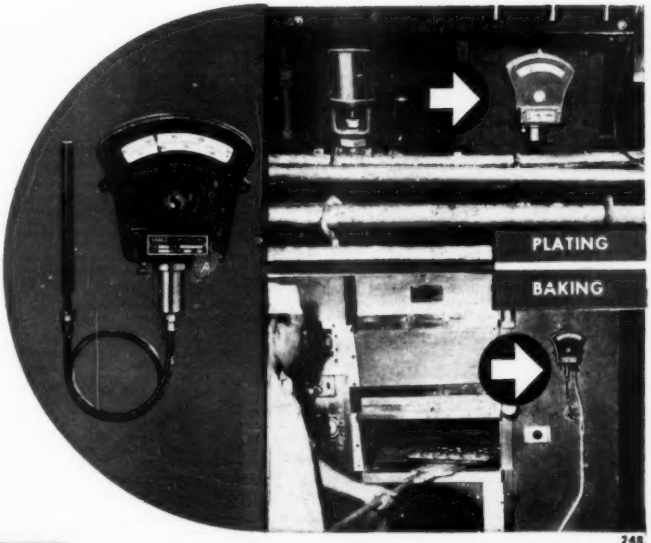
Twenty presses are used in this New York plant to seal and cement powder puffs and other novelties. Each press is equipped with a Sarco L S I Electric Control. Each operator starts with a temperature exactly right for her work—and the setting may be changed in a minute for a change in work.



Reject losses have been cut from 10% down to 1%. Inspection time is reduced, production per machine is up.

THIS IS THE INEXPENSIVE CONTROL

used extensively for plating tanks, baking, cooking and similar operations. Temperature setting may be changed over wide range by moving hand knob. Built-in thermometer indicates controlled temperature continuously on large dial.



248

SARCO
SAVES STEAM

SARCO COMPANY, INC.
Represented in Principal Cities
Empire State Building, New York 1, N. Y.
SARCO CANADA, LTD., TORONTO 8, ONTARIO

applied as easily as an adhesive tape. There is no special adhesive to apply to the floor surface, no brush or other application equipment. The bulletin states that you just pull off the Holland Cloth backing, apply the adhesive face to the floor and roll or hammer to make complete contact. The bulletins present excellent photographs of various types of uses for the safety walk and samples in different colors, are included. Minnesota Mining and Mfg. Co.

111 The Quonset 20—This bulletin tells about the "Quonset 20" an all steel building of many uses. Specifications in a condensed form are presented and excellent illustrations show the multitude of uses to which this practical all steel building has been put in both industry and farming. A listing of the uses of the building are presented on the back page of the folder. Stran-Steel Division, Great Lakes Steel Corporation.

MATERIALS HANDLING

112 Gravity Wheel Conveyors—This company has just issued an attractive 2 color, 24 page catalog, covering its complete and diversified line of precision built gravity wheel conveyors. In this comprehensive catalog the manufacturer presents specifications, data, and capacities of its entire line. Also presented are many illustrations which will be of assistance in solving any company's materials handling problem. Harry J. Ferguson Co.

113 Dry Materials Conveyor—Bulletin F-H-1 describes this company's revolutionary type of conveyor designed for the handling of fine, dry materials. The book, which contains 12 pages, presents excellent installation views of the conveyor, and also drawings which illustrate construction and method of operation. The bulletin points out that the conveyor has no moving parts and that it has no hazards to workmen, is silent in operation, requires no lubrication and can pass around obstacles. Fuller Company.

114 Snow Loading—This new bulletin gives complete details of two new snow loaders, a utility model and a heavy duty model. The bulletin tells in detail about both units and describes the advantages derived from the use of teeth on the feeder mechanism so that it picks before it shovels. The two models are Utility Model KR-5 and Heavy Duty Model R-10. The bulletin presents many action photographs of the snow loaders around industrial plants and similar locations. N. P. Nelson Iron Works, Inc.

115 Snow Removal—Bulletin No. SL522 is an attractive 2-color, 8 page Bulletin graphically describing operations and features of the company's new snow loader. Controls, various operating features and principles are adequately described. More than a piece of product literature, this booklet presents facts and figures to illustrate how the machine can pay for itself in one season by truck time savings alone. Barber-Greene Co.

116 Power Conveyor Handbook—Bulletin A-83-S, containing 40 pages has just been published. This booklet gives complete information and engineering data on the company's continuous power conveyor and the descriptions and explanations are accompanied by excellent installation photographs. Full pages of dimensioned diagrams are used to show the standard curves which are carried in stock and other sections show various types of floor column supports, suggested suspension methods, strap hangers, screw type take-ups, weight type take-ups, typical layouts of conveyors with bins of materials, special load pendants and many other features. The book is extremely well illustrated and should prove of exceptional value to all plant engineers. Richards-Wilcox Manufacturing Co.

117 Trolley Conveyors Manual—"Make Ceilings Pay Dividends" is the title of this new 28 page, illustrated Book No. 2330. Some 30 illustrations depict a great variety of actual installations and show the flexible adaptability of this type of conveyor. Among the more unusual uses shown is a trolley conveyor with rods hanging from the trolleys to assist tired miners up a hillside when they come out of the mine at the end of a day's work. Trolley conveyors that are electrified with bus bars along the conveyor track, to provide current for continuous testing of such articles as electric fans and freezer boxes are shown. Another interesting feature, picturewise, is the great variety of specially made hangers that are used for suspending the product, either singly or packaged, from the endless conveyor chain. There are photos of conveyors in warehouses, foundries, textile mills, bakeries, electrical plants and many other types of industries. This is truly a book of ideas for mechanized handling, gentle handling, coordination of plant operations and straight-line production regardless of arrangement of buildings. Link-Belt Company.

118 Interfloor Belt Conveyor—This company's interfloor escalator-type power belt conveyor is described and illustrated in a new 4 page, two color bulletin. This bulletin shows how one of the conveyors may be used to receive and transport merchandise from trucks to upper floor warehousing space to save as much as 60 per cent in time and man-power. Features of the unit are outlined in a single panel and include the nosed-over delivery, power driven feeder sections, self-supporting drive end feeder and many others. The Rapids-Standard Co., Inc.

INSTRUMENTS, CONTROLS, METERS

119 Instrument Selection Made Easy—A completely revised edition of this "Guide to Correct Instrument Selection" has just been published. In addition to giving a comprehensive view of the company's entire industrial instrument line, the field of application of each type of instrument is covered as well as its principle of operation and range limits. The booklet is broken down according to the variables to be measured or controlled, such as temperature, humidity, pressure, flow, liquid level, force and time cycle. Special function instruments are treated separately and include time-schedule, pneumatic set, ratio, electric contact, remote pneumatic transmission, expansion-stem type and self-acting controllers. Diaphragm valves, lever motors and precision valve positioning units are also included in the same section. Other pages give descriptions of mercury-in-glass thermometers for use in industrial apparatus and intermittent testing; etched-stem thermometers and hydrometers for laboratories and general industrial use; and information on coordinated control systems. Taylor Instrument Companies.

120 pH and Conductivity—pH and conductivity control and their application to different industrial processes is a feature of Catalog 15-12. Typical examples presented in the bulletin include pH control in heavy chemcial industries, agricultural chemistry, electroplating, pulp and paper, research, food and steel industries, conductivity conol in water treatment, power plants and the textile industry. It also offers a discussion of the fundamentals of pH, oxidation-reduction potential and conductivity and describes such instruments as the Electronik Potentiometer, Flow Electrode Assembly, the Beckman pH amplifier and others. The 43 pages are well illustrated. The Brown Instrument Co.

121 Speed Measurement—The description, operation and selection of chronometric, centrifugal and resonant reed tachometers are attractively presented in this new 26 page Bulletin 35-53. It includes a variety of proven integrating and direct indicating instruments, together with such variations as the Tachonorm, Tachoscope, Tachograph and many adaptations of the resonant reed principle. A wide selection of ranges up to 100,000 rpm are available in single and multi-range instruments. James G. Biddle Co.

122 Process Controls and Instruments—Bulletin 17A describes instruments and controls for process industries such as food, textiles, pulp and paper, chemicals, and others. The book is illustrated with exceptionally fine line drawings which illustrate typical applications and typical control systems. Control components and measuring components are covered in separate sections. Bailey Meter Co.

123 Industrial Motor Control—Bulletin 18-110-1 is descriptive of the company's line of electronic adjustable speed drives for the control of motors in industry. Complete descriptions of the controllers are presented and list of typical applications are given. Descriptions of operation including starting, speed regulator, dynamic breaking and drive efficiency are given. The bulletin is exceptionally well illustrated. Westinghouse Electric Corporation.

124 Pneumatic Transmission Data Book—This new data book No. 1001 describes the company's pneumatic transmitters and their application to the measurement of flow, level, pressure and density. The bulletin contains 32 pages and starts off with an excellent outline of the principle of force-balance, gives the operating principle of the differential pressure transmitter, its design features and performance features and operating adaptability. Similar procedures are followed for the other instruments in the line. The booklet is exceptionally well illustrated. Republic Flow Meters Co.

Mark the numbers of the bulletins you wish to receive on the no obligation, no postage card between Pages 18 and 19 and 58 and 59

PUMPS, COMPRESSORS

125 Compressors, Steam Jet Exhausters—This new Bulletin 4-E, describes the company's complete line of steam jet exhausters and compressors for use in connection with pump priming, exhausting, evacuating, cleaning, transporting and agitating liquids and gases. Tables, charts and three-color drawings are used extensively throughout the bulletin to show the construction and operation of the exhausters and their sizes, dimensions and capacities. Colored diagrams graphically illustrate typical applications. Schutte & Koerting Co.

126 Power for Pumps—Form F1454 is a 12 page, 4 color, illustrated booklet describing this company's motor which has been designed to provide power for pumps. Features of the motor are high-lighted by excellent 4 color illustrations. For instance, the section on "Downdraft Ventilation" is illustrated by means of colored diagrams representing cool air, a separating air zone and exhausted warm air. This diagram shows graphically how far the exhaust air is dispersed parallel to the ground before the air blast begins to dissipate. Other sections which point out features of the unit are titled "Asbestos Protection," "Normalized Castings," and many others. U. S. Electrical Motors, Inc.

127 Condensate Return Units—Section 199 is a catalog insert which describes this company's "Packaged" condensate return unit. Complete descriptions of the unit are presented along with specifications and selection tables. Outstanding features of the unit are described and illustrated. Roy E. Roth Co.

MECHANICAL POWER TRANSMISSION

128 V-Belt Engineering Book—The title of Bulletin VE-48 is "Engineering Bulletin on V-Belt Drives." This book contains 32 pages and is crammed full of engineering information on the following subjects: V-belts, sheaves, made to order sheaves and other V-belt equipment. Included in the "Engineering Tables" are horse-power ratings for the five section V-Belts—A, B, C, D, and E; correction factors for arc of contact on small sheaves; Belt velocities in feet per minute for various pitch diameter motor sheaves; V-belt pitch length; speeds and ratios; flywheel effect; and similar information. Drive selection tables and tables of sheave weights also are given. A few pages of the book are illustrated, but the major portion consists of tabular and installation information. Typical of the former is "Selecting a V-Drive" and "Data Necessary to Order a V-Belt Drive." The Medart Company.

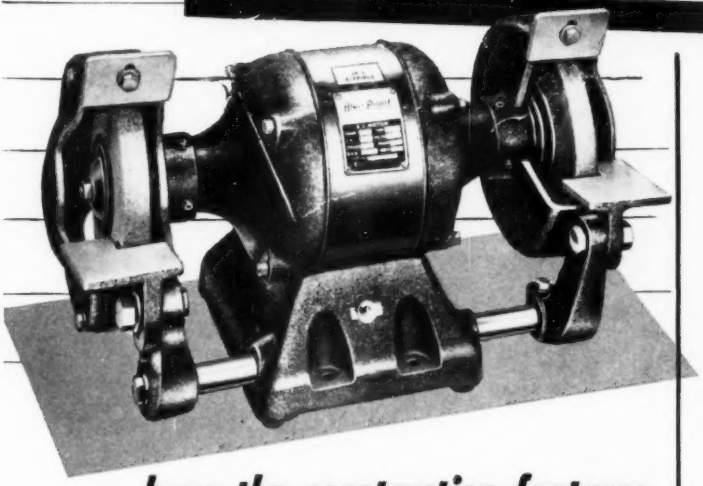
129 V-Belts Bulletin—A new catalog section, 2170, describing Multicord and Grommet Multi-V-Belts has just been published. This new catalog section pictures and describes construction of these V-belts and gives belt numbers, sizes and pitch lengths. One of the features of the section is a suggested procedure for designing drives using the company's Multi-V-belts. The problem is outlined, step-by-step methods given and the solution of the problem revealed. The B. F. Goodrich Co.

130 Roller Chain—The publication of this new 8 page catalog should prove useful in ordering many sizes of hard-to-get roller chain. The catalog lists prices, and gives specifications for single and multiple chains, ranging in size from No. 25 to No. 200. Prices and specifications for lug type attachments covering this range are also included. Several improvements in the design and production of roller chain have

(Continued on page 70)

Snap-on Bench Grinders

with the famous Blue-Point Trade Mark



. . . have the construction features for smooth, powerful operation . . .

COMPLETELY ENCLOSED MOTOR: Super-powered, precision-balanced motors enclosed to prevent dirt, grit, etc. from entering.

BALL BEARING CONSTRUCTION: Oversize, grease sealed ball bearings used throughout, assure smooth motor operation.

LARGE RUGGED BASE: Rubber feet provide solid mounting free from vibration. Recessed bolt openings for permanent mounting.

INDUCTION RUN MOTOR: Develops less heat in the windings — more desirable for continuous operation.

STURDY TOOL RESTS: Adjustable for any type of work with ample take-up for wheel wear.

LARGE WHEEL GUARDS: Allow use of special shape grinding wheels or wire brushes. Guards fitted with chip breakers.

BELL TYPE CONSTRUCTION: Provides full clearance so that long straight pieces may be ground across the face of the machine.

CAPACITOR START MOTOR: Uses low starting current . . . actually less than 15 amps. are consumed.

VOLTAGE: Standard models of the ⅓ H.P. and ½ H.P. grinder require 110 Volts, 50/60 cycle AC current. Standard 1 H.P. grinder takes 220 Volts, 50/60 cycle AC current. Special voltage models available.

GRINDING WHEELS

of natural aluminous oxide abrasive . . . fully vitrified. From 60 grit for fine grinding to 24 grit for heavy work.

WIRE WHEEL BRUSHES

High quality wire and metal, bound to prevent chips flying loose. Crimped bristles cannot bend or break.

WHEEL DRESSER

Quickly trues, cleans grinding wheels. Protective hood over cutters. Includes extra set of easily inserted cutter wheels.

STURDY EYE SHIELDS

Thick safety glass for clear vision, protection. Sturdy aluminum frame. Easily attached to grinder.

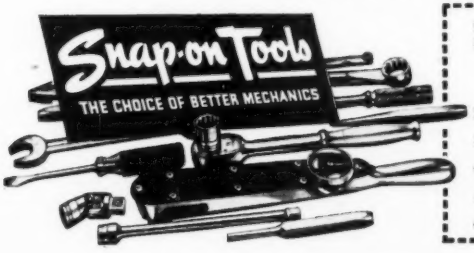
DRILL GRINDING ATTACHMENT

Sharpens any drill from $\frac{3}{32}$" to ½" in diameter with both lips ground identical in length, clearance and angle. Micrometer screw controls feed.

SNAP-ON TOOLS CORPORATION

8054-A 28th AVENUE • KENOSHA, WISCONSIN

International Division: Kenosha, Wis., U. S. A.



SNAP-ON TOOLS CORPORATION
8054-A 28th Ave., Kenosha, Wisconsin

Please send me catalog containing more details about Bench Grinder and accessories.

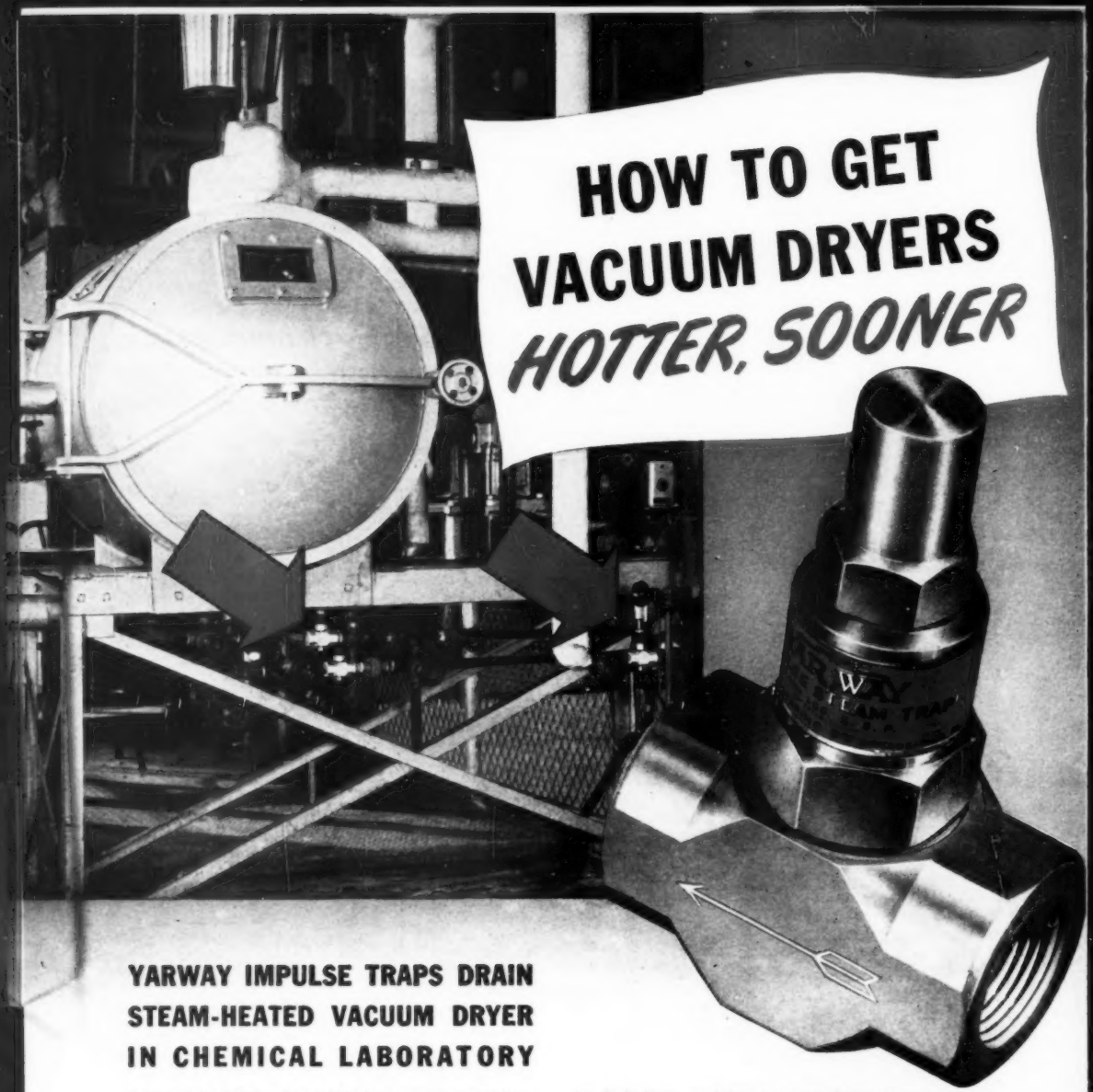
Name.....

Position.....

Company.....

Address.....

City.....(.....) State.....



HOW TO GET VACUUM DRYERS *HOTTER, SOONER*

YARWAY IMPULSE TRAPS DRAIN STEAM-HEATED VACUUM DRYER IN CHEMICAL LABORATORY

Industrial applications of high vacuum processing are constantly increasing . . . and so are installations of Yarway Impulse Steam Traps.

Here at the Eastern Regional Research Laboratory of the Department of Agriculture, three Yarways are shown on a steam-heated vacuum drum dryer in the Chemical Engineering and Development Division.

These and nearly 200 other Yarways used on various equipment in the laboratory, are doing a good job . . . and so they should. Yarways are famous for *getting equipment hotter, sooner, and keeping it hot. Continuous* discharge under heavy loads brings equipment to working temperature *sooner;* discharge at *short intervals* under lighter condensate loads *keeps it hot.*

Other Yarway features—one moving part, easy maintenance, small size, easy to install, suitable for all pressures, low price.

Try a Yarway today . . . standardize on Yarways tomorrow. See your local Mill Supply Dealer or write for Yarway Bulletin T-1739.

YARNALL-WARING COMPANY
145 Mermaid Ave., Philadelphia 18, Pa.

OVER 600,000 ALREADY PURCHASED!

YARWAY IMPULSE STEAM TRAP

Use Practical Specifications for Ordering Equipment

The Automotive Joint Industry Conference approves and publishes two standards or specifications for use in ordering all types of industrial equipment . . . Electrical Standards . . . Hydraulic Standards

PREPARATION of adequate and practical specifications for use in ordering equipment and material is one of the engineer's most difficult, and at the same time important, jobs. For this reason, two specifications recently approved by broad industry groups, are of unusual value.

Electrical Standards

J.I.C. Electrical Standards of Industrial Equipment were compiled by the: Automotive Joint Industry Conference; Industrial Elec. Eng. Soc. of Detroit; Industrial Furnace Mfrs. Assn., Inc.; Mechanical Press Builders Assn.; National Elec. Mfrs. Assn.; National Machine Tool Builders' Assn.; and the Resistance Welders Mfrs. Assn.

Industrial equipment in the specifications covers two classifications:

A. Power driven, complete metal working machines not portable by hand, used for progressively removing metal in the form of chips.

B. Other equipment not generally classified as machine tools, including: presses; furnaces and heating devices; welders; forging machines; plating equipment; washers; molding equipment (foundry); portable tools (arc welders); blasting equipment (abrasive); pumps and blowers; grinders (snag); conveyors; woodworking machinery; industrial processing, rolling, die casting and plastic equipment; etc.

Inasmuch as the specifications cover a wide range of equipment, certain paragraphs are included to cover special provisions or alternate specification requirements applicable only to furnace equipment; press equipment; and welding equipment. Furthermore, they have been correlated with, and keyed to, existing standards from: American Standards Assn.; National Electric Mfrs. Assn.; Resistance Welder Mfrs. Assn.; and American Soc. for Testing Materials.

A summary of the specifications are given in Table I. Including the title sheet, index, and contents, they require 29 8½ by 11 in. pages. The purpose is to provide detailed specifications for the ordering of electrical apparatus for application to industrial equipment to promote safety to personnel, uninterrupted production, long life of the equipment, and, still not limit or control development.

Hydraulic Standards

J.I.C. Hydraulic Standards for Industrial Equipment were compiled by: the Automotive Joint Industry Conference; Hydraulic Equipment Mfrs.; Hydraulic Press Mfrs.; National Machine Tool Builders Assn.; Resistance Welder Mfrs. Assn.; and, Tubing and Fittings Manufacturers. A summary of the standards are given by Table II. Complete they require 41 8½ by 11 in. pages.

Industrial Equipment includes machine tools as defined in Paragraph A above, and also, all other types of industrial equipment which are not generally classified as machine tools but which are hydraulically actuated. The purpose of the standards are, in general, the same as those for electrical equipment.

The problem of the committee was however, considerably different. Instead of dealing with a field already covered by standards with which the new specifications must agree and in supplement, the conferees in this case were invading virgin territory.

Therefore, an important and original part of the standards is a glossary of terms, for, until a nomenclature has been agreed upon, so that all are talking the same language, specifications are not practical. Another important part of the specifications, comparable in importance to the glossary, are standard symbols to be used for all circuit diagrams.

HOW TO OBTAIN COPIES OF THESE STANDARDS

These standards have not been reproduced because they should be available through the sponsor organizations, including most automotive companies.

Because of the recent date of publication, however, they may not be available through all sponsor organizations. The Editors have, therefore, made arrangements for readers to obtain copies through the courtesy of the General Motors Corporation.

Requests should be addressed to the: Production Engineering Section, General Motors Corporation, General Motors Building, Detroit 2, Michigan.

Specify the publication by complete title as:

1. J.I.C. Electrical Standards for Industrial Equipment.

2. J.I.C. Hydraulic Standards for Industrial Equipment.

Table I. Summary of the Electrical Standards. On both Table I and II numbers in parenthesis following each section heading indicates the number of paragraphs and sub-paragraphs in the complete standards

GENERAL (7)	
DIAGRAMS (8)	
Wiring Diagrams	Par. E1.1
Elementary Diagrams	E1.2
Standard Symbols	E1.3
Conduit Layout	E1.4
CONTROL (44)	
General Standards	E2.1
Disconnect Switch	E2.2
Protection	E2.3
Overcurrent Protection	E2.4
Control Enclosures	E2.5
Mounting	E2.6
Panel Wiring	E2.7
Type of Control	E2.8
MOTORS (13)	
Standards	E3.1
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METALLIZING — New Parts from Old

This form of rebuilding and repairing has its limitations and they are honestly admitted . . . But when properly used, in hundreds of applications, it can save thousands of dollars and can even make new parts better than the old ones . . . Motors, pumps, compressors, production machinery, machine shop equipment, all lend themselves to quick revitalization by this comparatively new tool for maintenance use

By **JOHN E. WAKEFIELD**

WEAR OF MECHANICAL parts is still a headache for the plant engineer and the master mechanic. Manufacturing establishments, mines, transportation facilities, power plants all are faced with this problem. Of course preventive maintenance programs have helped to reduce wear. Improvements in materials and methods have slowed it down too. On the other hand, production demands have offset some of the gains. Wear still goes on. Methods to combat it are still important.

The principal use of metallizing today is in exactly that field. Worn or undersize machine parts are being rebuilt in many thousands of plants of various kinds. There are other uses, too, in salvage, production, and corrosion protection, but the mechanical field is by far the most important to the average plant man.

In the average plant, there are a good many places where metallizing can be helpful. And, like any other process, there are some places where it shouldn't be used. Let's get those in mind. Knowing the limitations of a process first often gives a clearer picture of where it can be useful.

Limitations

There are three mechanical conditions under which metallizing should not be attempted. In all these cases, the peculiar structure of sprayed metal prevents its use. The first condition is direct impact, as on dies and punches. Sprayed metals won't stand impact. Don't try to use them where it occurs. At the same time, remember that very few mechanical parts are subjected to the same action that a die or punch has to take. A cam surface is probably the nearest to it, and metallizing is a very doubtful method of rebuilding cams. Certain types of valve seats, such as in a Diesel, can not be metallized either.

A second place in which the use of metallizing is to be avoided is on threads or gear teeth. Many threads and almost all gears operate under a tremendous strain. Both the particle adhesion and the bond won't stand such a strain. However, here again, it should be noted that few other mechanical parts have to stand such a condition.

The third bad spot for metallizing is where balls or rollers will run directly on the coating. It is well known that balls or rollers tend to elongate the surface on which they turn. Sprayed metals have low elongation, and furthermore, the coatings are usually much too thin. It is perfectly satisfactory to build up a shaft or housing for a bearing race fit. Here, of course, the balls or rollers do not come in contact with the sprayed metal.

To illustrate the last point, an actual job can be cited. Sprayed .80 carbon steel on a stamping press shaft stood up exactly two days under rollers. Remetallized and placed in a straight bronze bearing, it is still in excellent condition after several years of operation.

These three, then, are the general types of applications for which metallizing is not practical. By steering clear of them, predictable failures of sprayed metal coatings will be avoided.

It's an interesting fact, however, that few metallizing failures can be traced back to these conditions. Most failures which have occurred go back to human rather than mechanical faults. Almost all of them come from lack of knowledge or improper preparation of the base material. These matters can be corrected just as the predictable failures can be avoided. There are good handbooks available from metallizing equipment manufacturers covering preparation and other aspects of the process.

So much for the things to avoid in metallizing. On the other side of the picture, the process has a number of advantages for plant men. With the continued shortage of steel

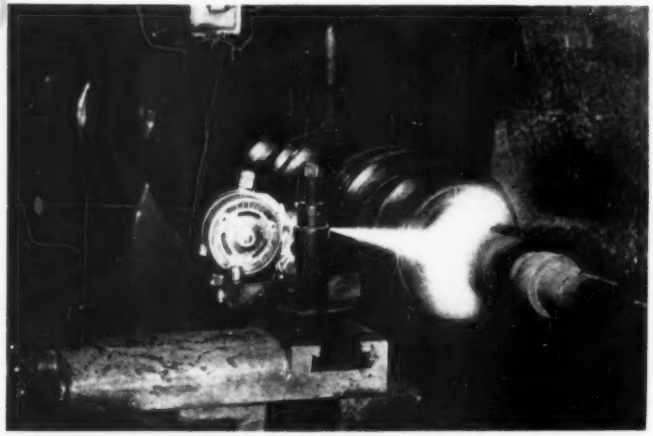


Fig. 1. One example of rebuilding worn parts with harder, better metals is shown here where a worn pump packing sleeve is being rebuilt with stainless

Fig. 2. Piston rods and reciprocating pump rods provide good spots for the application of metallizing

and some other metals, metallizing is a very practical means of saving many worn parts.

Advantages

Not the least advantage of metallizing is its speed. There seems to be a general misconception on that subject. Modern metallizing guns will spray more than 20 lb of carbon or stainless steels an hour. And, they'll do it without building up any appreciable heat in the base material. Most jobs are easily kept below 250 F. This is low enough so that no noticeable stresses are set up and distortion definitely does not occur.

Of course, in the past, overall time for metallizing shafts and the like has included fairly elaborate mechanical preparation. However, the recent discovery of a wire which bonds itself when sprayed, has changed even that. Much of the mechanical preparation is eliminated, and, as a result, the overall time shortened considerably. A shaft which has been cut away to show a coating of sprayed steel applied over an undercoating of the new self-bonding wire will show that there are no grooves or threads in the base. With this technique, metallizing today is a pretty fast proposition.

Oil Absorption Cuts Wear

Another peculiar advantage of sprayed metal comes from its structure. All metallized materials are porous as sprayed. Those pores absorb and hold oil. Absorption has been noted and studied in the laboratory. Many plant men have reported the disappearance of fairly large quantities of oil which had been placed on metallized shafts. Sprayed metal surfaces where the oil supply was intentionally cut off entirely have run up to 7 times as long as non-metallized surfaces under the same conditions. This oil absorption by sprayed metals simply means longer wear on lubricated surfaces and less frequent repair or replacement.

Perhaps the most important advantage of metallizing is its versatility. Any type of metal available in the proper wire size can be sprayed. Any of them can be applied to almost any type of base material. What that means to the plant engineer or master mechanic is that he can build up a mild steel shaft with a hard high carbon steel. Or, he can rebuild a worn bronze pump packing sleeve, like the one shown in Fig. 1, with stainless. It means that ordinary shafts can be rebuilt with harder, better metals.

For example, one plant had bronze pump packing sleeves about 4 in. in diameter, badly scored for about ⅓ of their 14 in. length. They cost between $50.00 and $60.00 new, in bronze. In stainless steel, the manufacturer quoted $159.00 each. They were metallized with high chrome-high carbon stainless steel over the bronze for $22.00 each, and outlasted new bronze sleeves by more than 3 to 1.

Motors: Motors are one of the commonest metallizing jobs. Worn shafts can be rebuilt. It isn't necessary to remove the shaft from the winding. The whole assembly can often be put in the lathe while the shaft is metallized. The winding itself should be covered to keep out dust, but this can usually be done quite easily with paper. All sizes and types of motor shafts have been done, from fractional horse power motors to very large ones.

Another application on motors is the rebuilding of bearing race fits. Sometimes the fit is lost in the bell end. Many plants have bored out the inside diameter slightly, metallized and rebored to size. It's an inexpensive and quite rapid operation, and the heat of metallizing is so low that no damage or distortion occurs.

Pumps: Pumps, of course, present a number of good uses for sprayed metals. Packing sleeves have already been mentioned. One large Montana copper mine rebuilds literally hundreds of worn stainless steel sleeves a year. They simply rough down the sleeve, spray hard stainless on it and regrind to standard size. They state that savings run into $18.00 or more on every sleeve.

Another good pump application is on impeller hubs. Sometimes these are in bad shape while the vanes are still satisfactory. It's a fairly simple matter to rough down the hub, build it up with bronze and refinish to the desired size.

Compressors: Compressors give metallizing quite a bit of use in many plants. Compressor crank-

Fig. 3. Here a metallizing job is being done on damaged raceways of a lathe. Generally only a light build up is necessary in jobs of this type

Questions on Metallizing Answered by an Authority!

John E. Wakefield, author of this article, has offered to answer any questions on metallizing which readers of PLANT ENGINEERING may have. This service is offered, without charge, in order to avoid poor applications of metallizing and to prevent definite metallizing failures. Just address your questions to Metallizing, Editorial Department, PLANT ENGINEERING, 53 West Jackson Blvd., Chicago 4, Ill.

Fig. 4. In this photo a punch press crankshaft is being inspected after having been restored to size by metallizing

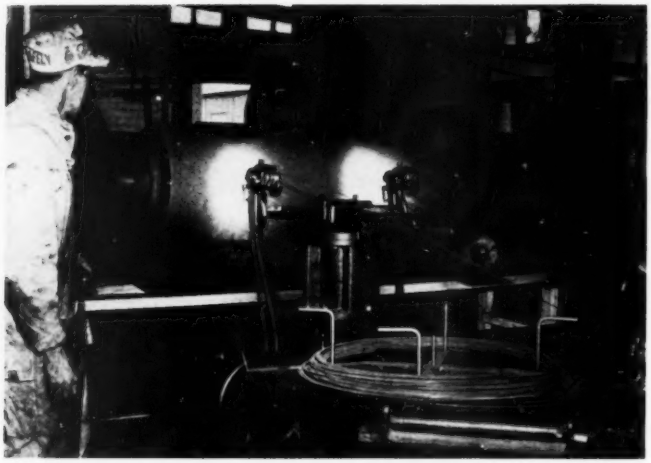


Fig. 5. Many industries use rolls for various purposes in their production work. One company uses low-cost rolls made of cast iron pipe with plugged ends and then metallizes them with stainless

shafts are quite an item to replace. They're metallized quite successfully. A machineable steel, such as .10 carbon, can be used, or, if grinding equipment is available, it's even better to use .80 carbon or high chrome-high carbon stainless steel.

Pistons can be built up. Here, much more careful preparation is necessary, because of interrupted diameters. It's advisable to groove or rough thread the pistons to provide good mechanical anchorage for the sprayed metal. Also, care should be used to bevel the finished sprayed metal slightly at the edges of the ring grooves. This prevents rings from riding on the rather weak corner of sprayed metal.

Piston rods and reciprocating pump rods, such as in Fig. 2 are good spots for metallizing. Here again, due to the type of action, threading or grooving is advisable before metallizing. Generally, the action on a reciprocating surface is more severe than on a rotating one, so a stronger bond for the coating is needed.

Machine Shop

In the machine shop itself, there are a number of applications. Two main types are worthy of discussion. The first is spindles. One company recently reported rebuilding two bearing race fits on a Browne & Sharpe hollow automatic screw machine spindle. The fits had been lost in operation and two different diameters had to be built up about 0.004 in. This company reported a total cost for the job of about $2.75.

Another spot where metallizing has been useful is restoring damaged lathe ways. Figure 3 shows the metallizing being done. This is the type of work on which the new self-bonding undercoat is a great advantage. Generally only a light build-up is necessary. The surface should be thoroughly cleaned before applying the undercoat. It won't fuse to oily or dirty surfaces. Put on about 0.001 in. to 0.015 in. of the undercoat and finish the build-up with low carbon steel or iron wire. Either of them is readily machineable.

Production Machinery

In the field of machinery used for production, metallizing is valuable too. Figure 4 is a punch press crankshaft that has been metallized to restore to size. On work of this kind, metallizing is about the only satisfactory way to rebuild. Such a shaft is quite a proposition to replace.

Hydraulic presses are used nowadays for a great many different purposes. In rubber, plastics and plywood plants particularly, there are often scored rams. One large manufacturer of plastics has metallized several hundred rams of varying sizes from 4 in. to 24 in. diameter. They've found that high chrome—high carbon stainless stands up well and saves considerable in packing casts. Some of their rams operate at pressures as high as 4000 psi. On rams, the porosity of sprayed metals is a slight problem. In some cases, the pressure has forced the liquid in through the coating and cracked it. This won't happen, however, where heavy coatings of stainless are applied and properly sealed. Apply about ⅛ in. on the radius, then dip into or paint with raw tung oil mixed with a 5 per cent solution of cobalt liquid drier. Apply the tung oil and cobalt solution while the part is still warm. Saturate it and allow it to dry thoroughly before finishing.

Rolls, such as the one in Fig. 5 are used extensively in industry for manufacturing many products. Paper, roofing materials, textile, printing and lithography are industries that come to mind. Rolls are rebuilt to great advantage. Journals frequently wear. Roll bodies themselves are often subject to corrosion and wear. Anvil rolls, breast rolls, couch rolls and many others need attention from time to time. Often a coating of sprayed stainless steel, monel, nickel or bronze is the solution to wear or corrosion or both.

For example, one manufacturer of asphalt roofing materials makes many rolls out of cast iron pipe, with plugged ends and journals inserted. Such rolls cost about $200.00 each. Similar rolls made of stainless tubing ran over $600.00 apiece. By metallizing the iron rolls with stainless, they got the hard, non-corro-

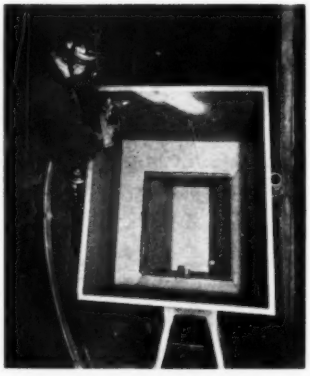


Fig. 6. Vapor degreasers are subject to corrosion but can be protected with a coating of sprayed zinc

sive surface they wanted for about $300.00, $200.00 for the iron roll and another $100.00 for metallizing.

There's one other job that should be included here. It isn't strictly mechanical, but it occurs quite often in many plants. Vapor degreasers, such as those shown in Fig. 6 are subject to rather severe corrosion. Most of them today are protected, when new, by a coating of sprayed zinc. However, hydrochloric acid forms in them near the condenser coil or unit and eats the coating away. The tank can be sand or grit blasted and recoated with zinc using the same gun that does the mechanical build-up work. A coating of 0.025 in. of zinc will stand up for quite a long time. If, as sometimes happens, the blasting goes right through some sections of the tank that are badly corroded, it is a simple matter to weld in a new steel band and then metallize.

There are many other jobs which occur in many plants. Fan shafts, diesel valve stems, gear fits and the like can be restored to size. However, space does not permit of any further discussion. It is hoped that this article has served to suggest some of the worthwhile spots for metallizing, as well as indicating some of the places where it shouldn't be used. Saving downtime, saving metal and money are all pretty important to plant engineers.

SELECTION, USE, AND CARE OF TOOLS

Introduction—Choosing the Right Tool

By THOMAS TRAIL

WHETHER THE tools used in the shop are provided by the mechanic or the company they should be selected intelligently, used properly, and cared for adequately. Often too little attention is given to these matters and the result is far from satisfactory.

Tools are made in several grades, varying in quality from those sold in dime stores to the best products of long established fine tool manufacturers. In order to choose tools best suited to the needs of a particular type of work it is necessary to consider several factors. If the work being done calls for only moderate skill and is performed relatively infrequently, inexpensive but well made tools will serve the purpose. However, where tools are used extensively and for highly skilled tasks only the best grades available should be selected. While a good mechanic can do good work even with poor tools, he can do better work with better tools.

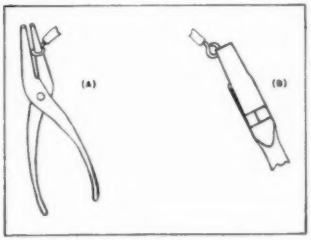


Fig. 1. This drawing illustrates one point in Mr. Trail's article: It isn't necessary to have a specialized tool for every job, such as the wire-looping pliers at (a). The job can be done by ordinary linemen's pliers. However, if the job calls for the formation of a lot of wire loops then it pays to have the specialized tool

In buying tools it is well to insist on those made by well known manufacturers. Such firms cannot afford to jeopardize their established reputations, by turning out tools of inferior quality. While there are some newer companies producing excellent lines of tools, it is advisable to carefully ascertain the quality of such tools before investing in them. Naturally there are some firms making tools of questionable or inferior quality. Tools of this type are of little value and usually represent a waste of the purchase price.

There are many factors that determine the quality of a tool. For example, a good screwdriver should have a blade made of tough steel properly forged, shaped, hardened and ground. The handle should provide a generous and comfortable grip and should be well secured to the blade to prevent turning or loosening. A cheap screwdriver will possess few if any of these requisites. It is likely that the materials used will be inferior, the design and workmanship poor, and the tool as a whole unsatisfactory.

Aside from the satisfaction and utility provided by a quality made tool, which justify the higher cost, such a tool will far outlast the cheap variety. Consequently it is actually less expensive to invest in good tools than to buy those whose lower first cost makes them seem the better buy.

In selecting tools it is well to give careful consideration to what types are actually needed. It is much better to purchase a lesser number of good tools that will be used frequently than to choose a greater variety and have to sacrifice quality in order to pay for quantity. While it is convenient to possess every tool required for the type of work being done, it will often be found that the need for certain tools is so infrequent as to fail to justify their purchase. Usually with a little improvising or slight temporary inconvenience it is possible to make an ordinary tool do an out-of-the-ordinary job.

An example of this is shown in Fig. 1. It is, of course, easier to form wire terminal loops with a special pliers as shown at (A), but the average electrican finds that a regular lineman's type pliers, as shown at (B), produces sufficiently serviceable loops to make it unnecessary to possess the extra pliers. However,

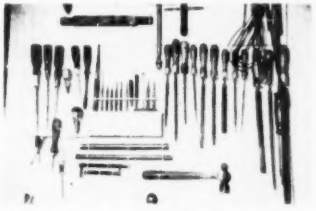


Fig. 2. Neatly arranged wall boards for tools aids in the quick selection of the proper tool

a workman doing a great deal of terminal wiring would find the added cost of the wire looping pliers a worthwhile investment.

The best plan to follow in buying tools is to get only those that experience has shown are definitely needed. Of course, there are certain tools on the market that are designed to take care of tasks that would be difficult or time-consuming without their aid. Some of these represent wise investments, even though they may be used at very infrequent intervals, since the time they save is often worth more than their cost.

In order to obtain the maximum use from tools it is important that they be kept conveniently at hand. Tools buried deep in a box are likely to be overlooked or neglected. This results in less efficient tools being substituted. Where tools are kept neatly arranged on a wall board, such as is shown in Fig. 2, they will achieve their greatest utility because it will be as easy to choose the right one as to pick a substitute.

Industrial Lighting Installation

Fig. 1. View down the length of the shop area showing the location of the luminaires in relation to the crane and ceilbeams. The lighting is described as "pleasant and of a sufficient intensity to illuminate in greatest detail all work being done."

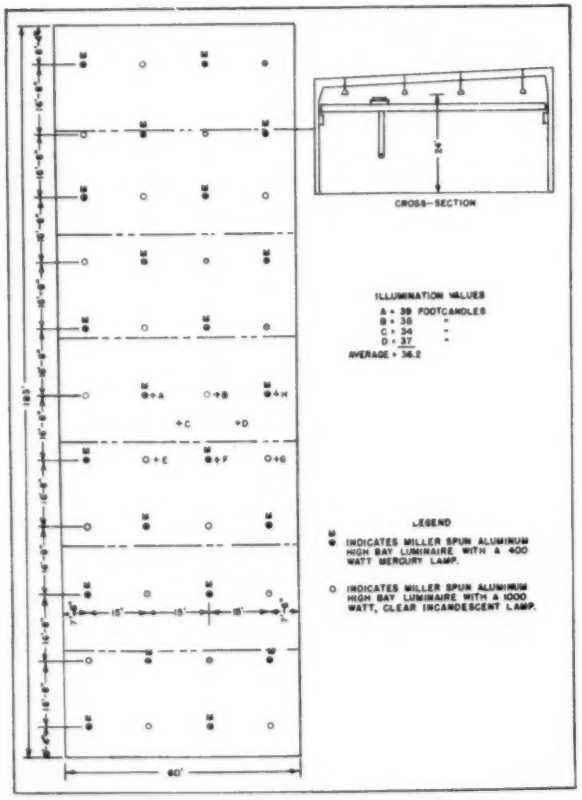


Fig. 2. Plan view of the shop area showing the location of the mercury and incandescent luminaires and how they are staggered in relation to each other

ADVANTAGES to be gained by a combination of mercury lamps and incandescent lamps were realized by the Air Reduction Sales Co. at Murray Hill, N. J., in the shop where the heavy work for their laboratory is performed. The mercury and incandescent lighting units were staggered in such a manner that light from each overlapped others, providing a mixed lighting that proved uniform, shadowless and nonglaring.

E. J. White, who engineered the installation, won a Merit Award in the industrial section of the 2nd International Lighting Exposition and Conference, with the entry that is presented here.

Relation of the luminaires to each other, the floor, and the moving crane is shown in Figs. 1 and 2. The readings of lighting intensity were taken with a Weston Model 603 Illuminator at 9:45 p.m. With 400 w mercury and 1000 w clear incandescent lamps the total current consumption is 31.9 kw per hr. Complete illumination data is given in the table with a detailed description of the luminaires.

Engineering Assistant, D. L. Smith, of the Air Reduction Sales Co., commented on the installation: "We feel that this type of lighting gives us uniform illumination. The lighting is pleasant and is of sufficient intensity to illuminate in greatest detail all work being done on our various machines. It is a well known fact that good lighting is conducive to accurate and precise workmanship and because of these advantages we feel sure that the morale of our personnel will be the highest and that working conditions will be the safest."

Table of illumination data of the lighting system in the shop area and description of the luminaires used

Illumination		
Under mercury unit A		39.0
Under incandescent unit B		35.0
Center of 4 units C		34.0
Under mercury unit in side row H		39.0
Under incandescent unit in side row G		21.0
Average (30 in. above floor)		36.2
Description of luminaires		
Manufacturer: The Miller Co.		
Type: Sun aluminum high bay		
Catalog No.: PXAN		
Finish of reflector: Alzak Aluminum		
Dia. of reflector: 18 in.		
Types of lamps		
Mercury: 400 w high intensity H-1 Wattage with ballast—450		
Incandescent: 1000 w PS-52 clear		
Number of luminaires and current consumed		
Mercury:	22 units	9.9 kw
Incandescent:	22 units	22.0 kw
Total:	44 units	31.9 kw

Pulley Balancing With Pressure On

Contributed by Herbert Bonton

A LARGE re-sawing machine which was used to make needed sizes of lumber out of larger sizes that were in stock had been used for 15 yr but only at infrequent intervals, which may account for its undetected bad condition. It was pulling a 4 in band saw at 10,000 fpm with 5 ft diameter pulleys.

A large hurry-up order came through for which the saw was put into operation. After a short run of heavy sawing, complaints began to come in from the crew; they were afraid of the way the machine was performing. Reports stated that the upper pulley seemed to be badly out of balance. To the plant engineer this did not seem reasonable as the machine had been doing all right for many years. There seemed to be no way it could suddenly get out of balance unless it had been balanced originally by adding weights on the light side of the pulley and some of these weights had suddenly come loose.

Inspection showed, nevertheless, that the machine was in dangerous condition, and that there had never been any balancing weights fastened to the pulley. The plant engineer rigged up hoists that could handle the 1000 lb pulley and dismantled the machine. The center of the pulley was 8 ft above the floor. Having no lathe at hand that could swing such a job he sent it out to a shop that had done excellent work in the past.

With it he sent the tapered wheelseat shaft, with instructions to test the shaft for trueness, and if it proved correct to mount the pulley on it in its normal position.

To make doubly sure the machine shop was instructed to test the pulley for balance and to do any work necessary to perfect its balance. When the pulley was reinstalled the production department was screaming for speed as it had a line of machines set up and waiting for the stock. So the rigging was dismantled and the machine gotten ready for its start as rapidly as possible. But when the initial run was made the installation behaved no better than before—it was too dangerous to tolerate. A check with the machine shop brought the assurance that the wheel had been perfectly balanced there. The plant engineer then decided to make a personal test for balance and although this involved replacing the rigging and a second dismantling, the machining of a special taper arbor, and the setting up of a special set of balancing ways it was done.

When the wheel was first placed on the ways for a test, it was shown to be far out of balance. It was decided that the pulley should be put in balance by removing weight from the heavy side; the weight thus could be removed at exactly the right spot and once it was balanced correctly there was no way for the pulley to get out of balance again.

There was a heavy rib between the wheel spokes so chipping was resorted to until a rough balance was achieved. A keen file was then used and the work went on until the wheel would stand in balance at any point of the circle. Then as a final precaution the operator walked away for an hour and came back fresh and checked the job all over again.

When the job was reassembled it ran with no trace of vibration. It simply settled down, sawed wood and made no more trouble.

Plug-in Strips for Testing

Contributed by
National Electric Products Corp.

THE TWO PHOTOGRAPHS accompanying this article are but two examples of the multitude of uses for a new plug-in strip. By providing a spread of electrical outlets at either 6 in. or 18 in. intervals along the top of, or on the walls behind laboratory tables, work benches and assembly counters, the strip gives maximum opportunity to "plug-in" equipment for light, heat or power, reduces fire hazards and eliminates the need for trailing extension cords.

The installation is made by joining either 3 ft or 6 ft standard lengths of the plug-in strip. The 24 ga steel channel and the two No. 12 copper wire conductors "factory-wired" inside the raceway may be cut to fit on the job with a hacksaw at any desired location between the receptacles. The plug-in strip does not have to be taken apart during installation.

The mounting of the plug-in strip is accomplished through the back of the steel channel or by streamlined mounting clips. When joining lengths of plug-in strip, a copper connector is crimped over the wire ends. This method of securing a permanent solid copper connection throughout the strip circuit eliminates soldered and screwed connections in the electrical circuit.

Fig. 1. A new method of distributing power of various voltages to test and adjustment benches is being used in many departments throughout the main plant of Burroughs Adding Machine Co., Detroit

Fig. 2. The manufacture of hearing aids requires making innumerable electrical connections in order to test thoroughly the products' wiring systems. The photo shows an efficient assembly and test set-up devised by C. L. Hofman Corp.

Insulating a Packaged Steam Generator Plant

By RALPH S. FRANKLIN,
Lockwood Greene Engineers, Inc.

BECAUSE THE equipment could no longer serve the manufacturing facilities adequately, it was decided to replace the boiler plant at the Ansonia O & C Co., Ansonia, Conn., manufacturer of elastic webbing and braid. In addition, investigation had disclosed that the labor cost of operating the old boilers, in use for 40 years, amounted to approximately 15 per cent more than the fuel cost in any one year. The old boilers were therefore replaced by a modern, efficient, fully automatic plant, designed so that a maximum saving in both fuel and labor costs could be obtained. As an important factor in the efficient and economical utilization of the generated steam, insulation of the steam generating and auxiliary equipment was given thorough consideration.

Company expansion over the years had totally enclosed the old boiler plant so that it was not possible to design the new one for use in the same general location. Instead, an existing dye house whose operation had become unnecessary was renovated for use as a boiler room.

It was determined that steam continuously maintained at a pressure of 12-15 psi would satisfy all production requirements. Four package type, oil-burning steam generators were chosen as being most suitable for the Ansonia plant, which operates with a variation in summer and winter load factors. The generators selected have a very fast steaming rate and a relatively small water content. To increase the water content of the battery as a whole, a 24-in. diameter header, about 26 ft long, was installed and centered on the waterline of the generators. The header acts as a "flywheel" to counterbalance rapid fluctuations of water level and also serves as the steam supply header to which the heating and process mains are connected. Water of condensation is returned through a deaerating heater mounted above a large conical-bottom receiver.

Plant operation is a form of sequence control which provides definate starting and stopping pressures for each burner through highly sensitive, micromatically adjustable pressure switches. In effect, the plant operates as if it were served by one boiler fired with four separate burners, since all four generators are kept hot at all times.

Specifications called for the use equipment in the form of blocks, of 85 per cent magnesia insulation on steam generating and handling semi-cylindrical pipe insulation, and cement.

Because of irregularities in the surface of the steam generators or boilers due to rivet heads, etc., a smooth surface was provided for the insulation by covering the boilers with 1-in. high ribbed netting. Magnesia blocks, 2 in. thick, were then applied over and firmly wired to the netting. The blocks were covered with a ½-in. thick layer of magnesia cement applied in two coats. Before the second coat was applied the first coat was allowed to dry thoroughly in order that no cracks or checks should develop in the cement. The magnesia cement was then gauged with a hard finish cement troweled level and smooth. The heater and receiver as well as the 24-in. main were insulated in the same manner as the boilers, except that the high-ribbed netting was omitted.

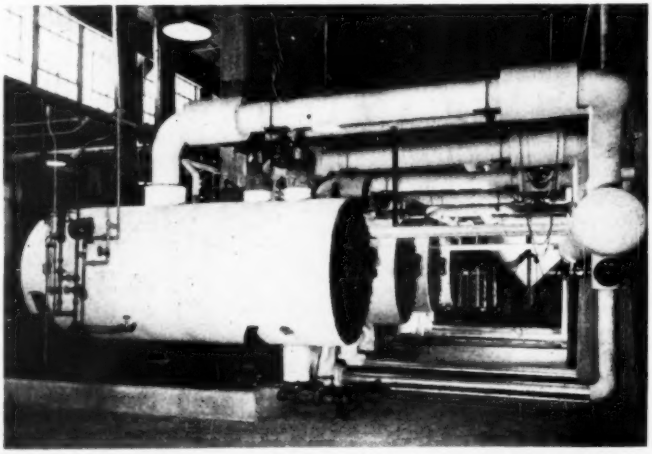
All boiler room piping, except blow-off, drain and oil piping, all steam supply piping, process return piping, and discharge piping from condensate and vacuum pumps were insulated with standard thick 85 per cent magnesia sectional insulation. Before application, care was taken to wipe all pipe surfaces clean of any scale, debris, etc., that might prevent the insulation from fitting properly.

Fittings on these lines were insulated with magnesia cement in thicknesses equal to that of the insulation on the adjoining piping. The cement was applied and finished in the same way as the cement on the boilers.

Insulation on all piping and equipment was jacketed with a 6-oz. canvas jacket. On the boilers it was pasted and sewed on, while on the piping it was pasted on. During application, the canvas was stretched tightly so that it would give a smooth appearance and take paint well. The jacket was painted with one coat of glue sizing and two coats of lead-in-oil paint.

Sections of piping that run outdoors across area or passage ways were insulated with double standard thick magnesia instead of standard thickness as a precaution against the variation in surrounding air temperature outdoors, as well as against inclement weather. Under such conditions, unless an adequate thickness of insulation is used, winds, rain, snow, etc., can cause excessive steam condensation. These lines were wrapped with two thicknesses of 45-lb weather-resistant roofing felt, applied with staggered joints and generous laps, and wired with copper wire every 6 in.

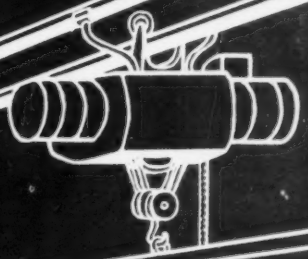
In operation, the plant performs satisfactorily and consistently maintains the steam pressure between 13 and 14.5 psig. Since the plant is compact, there is a comparatively large amount of heated surface area within a small volume of plant space. Nevetheless, the surrounding air temperature in the plant is kept at a comfortable level.



Four 125-hp packaged steam generators are shown in this photograph. Note the 24 in. diameter receiver in the right foreground and the conical receiver in the right background

Plant Engineering

A Specialized Section on



MATERIALS HANDLING

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The Current Aspect of Materials Handling

By RICHARD H. MORRIS, Editor, Plant Engineering

Industry places MH fourth of eight major problems . . . Mix knowledge, skill and practice with showmanship . . . Review of articles . . . General principles . . . Engineering economics . . . Analysis . . . Selling management . . . Cost records . . . Plan plantwise not haphazardly

OF THE EIGHT most pressing problems confronting American industry in today's struggle for lower production costs, materials handling ranks fourth. This is not opinion. It is the finding of a survey just conducted by the American Management Association among the executives of 1000 American companies.

Expressed, negatively as a masterpiece of understatement, in the language of the release, it is: "4. Less than maximum effectiveness in physical handling of materials in the manufacturing process."

Without quibbling, however, the significance of the statement, alone and in relation to the other seven, is threefold: First, it is tacit admission by management that effective materials handling is both important and inseparable from the production problem; second, materials handling is the only major engineering problem currently causing widespread concern; third, the impending 'competitive market' predictions are being taken seriously.

All this leaves the plant engineer in an enviable position professionally but in a tight spot personally. To the world he is the Fair Haired Boy groomed to slay the dragon of High Costs. To the boss, however, he is the boy paid to pull a rabbit out of the hat whenever the going gets rough.

A good performance of this kind requires knowledge, skill and practice artfully applied with a dash of showmanship. Materials handling is no exception. To do a good job a great deal must be known of the product and process from the receipt of raw material to the shipment of the finished product. Storage and marketing are important. The customer must be pleased, and pleased at the lowest possible cost. But with raw materials you are the customer and the one to say how it shall be delivered. Unit load shipments of lumber cut one industrial company's handling costs more than $7.00 per thousand board feet[1] or more than twice the vendor's increased charge.

It is self evident that a widespread knowledge of handling equipment and techniques is essential and that this knowledge must be applied with skill and ingenuity. Industries other than your own are a fertile source of new ideas. Approach articles and advertisements positively.

Manufacturer's representatives are ingenious fellows who see many things in many places. If not technicians themselves they usually have good technical support. On specialized work consulting engineers are valuable.

In spite of the fact that materials handling is an expanding and diversified art, certain general principles can be stated. This has been attempted many times but never has it been done as completely and effectively as by Sidney Reibel in the article starting on the next page.

Detailed analysis of a given problem is sometimes simple, sometimes very complex. The most practical method is by means of a flow process chart which is, in effect, a detailed breakdown by operations. How these are used for materials handling analysis is covered fully in the article by H. B. Maynard.

The kernel of the nut, however, is a presentation of the case in a way management will understand and approve. This is an art in itself, one covered effectively by John F. Roberts in an article following. Fundamentally it is the same as any engineering cost study. Practically in relation to materials handling, it presents some difficulties and has some advantages. Probably no other field is so well supplied with movies, models and visual aids.[2]

Cost studies as such are only touched upon in this section because the subject is well covered in standard work on engineering economics. Two phases are, however, presented in considerable detail because they are frequently slighted or misinterpreted.

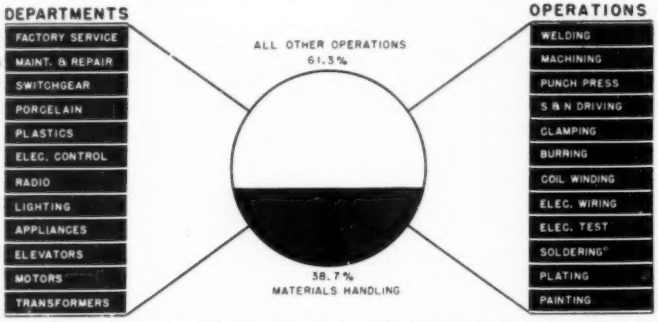
Depreciation and/or obsolescence is subject to many variations and is an element of major importance in any cost study. B. W. Whitehurst covers this subject thoroughly. Furthermore he goes beyond the engineer's problem to give a glimpse of additional factors that management must consider: the tax structure, Treasury Department rulings; and accounting practice.

Cost records are also of major importance. The engineer needs them for future cost studies and also to support past cost estimates. Management should have them for analysis of current operations. Management, engineering and cost accounting should be together on this subject. Donald W. Pennock outlines the problem, explains how it can be accomplished, and points to the importance of short term and long term planning.

Unfortunately, immediate emergencies often interrupt long term or overall system planning. This is unfortunate but true. Therefore, the importance of the latter cannot be overestimated. If the problem is attacked piecemeal the final result is likely to be a hodge podge that: does not fit well together; requires excessive and varied maintenance; and necessitates an excessive stock of spare parts to guarantee continuity of operation. Incidentally, AMA Problem No. 3 is "Maintenance inefficiency causing lost time for repairs."

[1] See "Lumber Handling Costs Cut 65 per cent" PLANT ENGINEERING, page 50, March 1948.

[2] See "You Can See These, Too!" PLANT ENGINEERING, page 46, February 1948.



In one company the manhours devoted to materials handling approximates 65 per cent of that devoted to all other major production operations. In the departments covered above, time was segregated and amounted to 38.7 per cent

Materials Handling Is Now a Dominant Factor in Industry

Today industry builds around materials handling . . . Basically the problem is better and less expensive ways to handle materials . . . Two broad classifications, the old and the modern . . . Consider the intangibles when comparing the two . . . Don't chase rainbows when making surveys, tie them in with current company policy . . . Surveys and factors to consider . . . General principles of modern MH with examples of good practice in the plant . . . Application of ideas

By SIDNEY REIBEL, Materials Handling Consultant
Albert Kahn Associated Architects and Engineers, Inc.

EVEN THE MOST casual study of the best industrial production methods emphasizes the single, basic principle that plants are built today around materials handling or, for simplicity, MH systems. The flow of material receives first consideration in the arrangement of machines in departments; in the relative location of departments; in provisions for receiving, storing inspection, assembly, packing, and shipping.

There are, for instance, no longer milling machine, lathe, planer, shaper, and similar specialized departments. They are grouped, instead, so that operations in sequence are performed by machines adjacent to each other. A straddle miller may be next to a multiple drill, with an internal grinder nearby—to reduce MH to a minimum. This is true even in small job shops where machines are made movable for frequently changing requirements.

The principle of material flow is the reason for the success of mass production. Effective use of conveyors and other mechanized equipment has made it possible to produce cars, stoves, refrigerators, radios, other appliances, and just about everything we use—at lower cost and in greater quantities than would otherwise be possible. If shoes were made by hand they would cost five to ten times as much as the factory made article, and because of very limited output would have to last 10 times as long. The benefits of mass production, which depends on mechanized MH for its success, are more far reaching than most people realize.

Industry, faced with ever rising costs of both labor and material, is carefully examining over and over again every means of making savings. The output of machine tools cannot be increased substantially until new ones are developed and produced. This is a long and costly process. Material costs are not ordinarily under the control of the user. Many industries, with plants large and small, that have already invested hundreds of millions in mechanized handling equipment, are exploring the MH field for further gains. They realize, along with others who have not yet taken full advantage of modern materials handling methods, that tremendous benefits are still possible.

We have been told many times that MH amounts to as much as 40 per cent of total labor costs, a field worth cultivating. The actual percentage will vary, depending on the type of industry, the degree of mechanization, the accuracy of the cost figures, and what was included as MH cost. How much of it can be saved is debatable, but there are documented cases where savings returned the entire initial investment within a year or less, sometimes in a single month. This has happened so many times, and in every branch of industry, that the question should be—not, "Will the savings justify the investment? — but, "How soon can we get the equipment in operation and start making money?"

Just how important is MH in industry? It is simply the movement of material from one point to another. But, imagine that all MH were to disappear leaving no knowledge or conceptiton of it. Immediately all industry would come to a dead stop. There is no way for any industry to function without movement of material, in other words, MH.

We can liken MH to the arteries and veins in our bodies that supply the organs with nourishment and tie their functions together. As long as they are in good operating condition, everything runs fine. But hardening of the arteries causes trouble. Antiquated, inefficient MH methods also cause trouble and expense, slow down the industrial machine, and reduce output. Disgusted plant operators, stuck with ancient handling techniques, not knowing that it is possible to improve conditions, are the ones who say MH is a necessary evil. But not those who use modern MH methods and equipment as efficient tools, like any other good tools, to reduce costs and increase production.

Two Broad Classes

MH can thus be divided into two broad classes: old ways and modern methods. When we cannot improve on the good old ways, we use them. Hand trucks, nonpowered roller lines, gravity chutes still have a

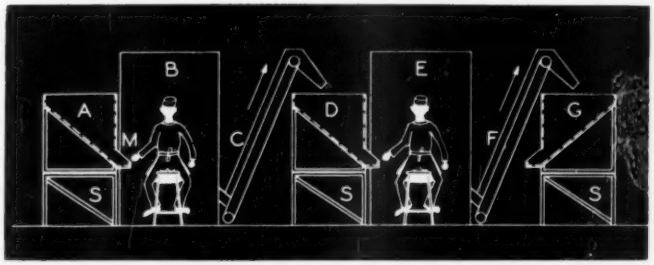


Fig. 1. Diagram illustrating good MH practice for small machine operations: Transport in unit load; handle individually; move mechanically; keep moving and keep off the floor. In practice space between machines is smaller as shown by later installation photographs

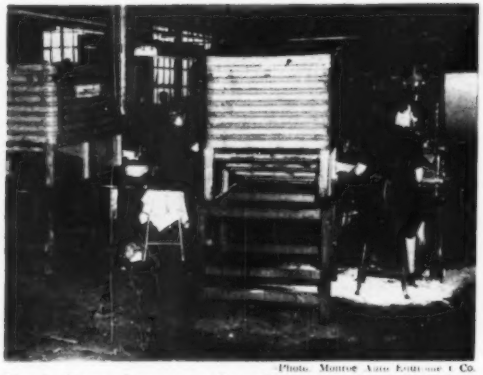


Photo: Monroe Auto Equipment Co.

Fig. 2. View of presses and special boxes. Operations here are not consecutive but the principle of operation is the same as outlined in Fig. 1. Fig. 3 shows the last operation

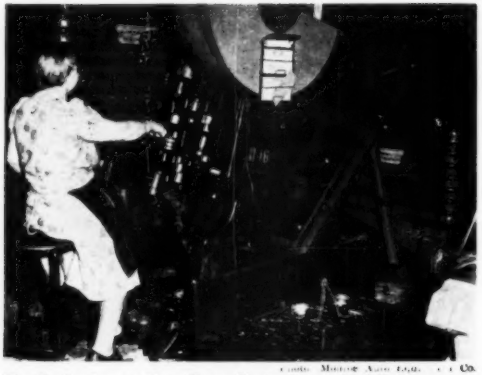


Photo: Monroe Auto Equipment Co.

Fig. 3. Last operation. Press discharges to inclined conveyor in rear which drops parts into the box on the floor. Elevated box at left has a bottom opening to feed parts to the operator

definite, important place in the modern picture. But the greatest savings are made when new, modern methods can be used to replace old, inefficient ways. Modern methods may be a misleading term.

Not Everything Started With World War II

All modern handling techniques were not developed overnight in the warehouses of the armed forces in World War II, despite some fairly successful attempts to create that impression. Most types of handling equipment in use today were fully developed, and techniques for using them definitely matured before the war started. Lately developed techniques have, however, widened the use of basic types, speeded them up, adapted them to new fields. There has been also the gradual development of improved types and equipment for handling higher capacities and heavier loads. New attachments greatly increase the range of work that individual types can do.

When the term materials handling or MH is used, it means all the movement of material in a plant, from picking raw stock up off the floor of a truck or a railroad car, through all operations to the loading of finished goods back to the floor of a truck or car. Any method used for this movement is MH, but the MH engineer unconsciously applies the term only to modern handling techniques. It explains why he speaks of the benefits and advantages of MH—what he really has in mind is *modern handling*, usually mechanized.

Consider The Intangibles! They Are Extremely Important

Except in mass production plants where long experience in their use has proved that any mechanized handling is indispensable and will always pay big dividends, it is necessary to justify the cost of installing and using the new method. The usual basis is to compare only present costs for handling with the estimated cost after the change. Whether or not this is fair is not the question here, but it is pertinent to point out that there are other indirect benefits, usually classed as intangibles because they are hard to determine that sometimes equal or even far exceed in value the direct saving in labor. They show up as

1. Actual increase in output: This is due to a number of factors including: pacing and better synchronization of production operations; regular delivery of material in proper quantity at correct time and place thus eliminating delays; more time spent by skilled operators on productive work and less on manual handling; reduced fatigue of operators; and better division of labor operations, a prime essential for high production. Greater output may make it unnecessary to increase the number of machines and operators, or to enlarge a plant, to meet increased production requirements.

2. Lower production costs: This is due to: greater output per man-hour and machine-hour; and mechanized movement that cuts down losses from damaged parts.

3. Better utilization of plant: Mechanized handling can transport material in otherwise unused overhead space instead of aisles, and provide storage in transit. Material in storage areas can be high stacked mechanically to double, triple, even quadruple amounts that can be stacked conveniently by hand. Except in unusual cases or in plants which cannot or will not use modern methods high stacking manually is now considered too uneconomical to tolerate.

4. Less work in process: Smaller inventory means lower taxes and interest; and less chance for damage, waste, theft losses. Inventory check or perpetual inventory is made easier.

There are also other benefits. In warehouse storage unit loads are handled faster, an advantage both in regular practice and in case of fire to remove goods in a hurry. Water damage also may be less.

A Survey Should— Consider These Specific Points

Assuming that the management has agreed to consider a program, the best way to find out how important a factor MH is in a particular plant is to make a survey. This should determine:

1. Amount of money available for improvements. No use working up schemes that will cost more than can be spent.

2. The nature of improvements to which management will agree: MH equipment only; moving or relocating machinery and departments; building alterations, additions or improvements; new plants. Again, no use suggesting programs which present company policy will not permit.

3. The physical characteristics of the location: type and construction of building; dimensions, column spacing, ceiling heights and clearances; obstructions; location of facilities, aisles (if fixed), elevators and their load ratings; receiving, storage, packing and shipping areas; fire walls, toilets, locker and wash rooms, entrances and exits; hazardous locations. In an existing plant most of these are fixed conditions. In a proposed new plant or addition, they can be considered in the light of the best plant layout and MH practice.

4. If the survey is to be plant-wide, or limited to one or more departments.

5. What is going to be handled: the nature of the material, its dimensions, shape, weight, special handling characteristics, fragility, and how much. The quantities of material to be handled are not only very important, but are sometimes very difficult to determine. It is not enough

to know how much is handled today. The requirement for the future must be anticipated, perhaps as far ahead as 5 yr. On this matter, a word of caution—*Never determine capacity by averaging output; always use peak production figures for determining the capacity of MH equipment.*

Example

If the output of a plant printing a weekly magazine is 4,000,000 copies in a single 80 hr period, the *average capacity* is 50,000 per hour. But there will be times when *peak* production will reach a figure of 62,000 per hr. This must be the capacity of the MH equipment, 62,000 per hr, *not* 50,000.

5. The sequence and order of operations through which the parts travel at present. This is shown on a flow chart, which will indicate the time spent in handling. This time may be determined by time study, or may have to be approximated.

6. The types of handling equipment in use at present: the containers, carriers, trucks, etc.: and conveyors and other MH equipment.

All of the steps listed are important factors, but only preliminary to the real job which is to find better and less expensive ways to handle the material. They are used as the foundation to apply modern MH methods.

How to apply modern MH methods will always be a problem without a final answer. It is not an exact science, but an art constantly developing to meet changing conditions and the increasing demands of industry. As in any art, there are very few rules that have general applications; what works well in one case may not be as suitable as something else in another similar, but not exactly equal, case.

Perhaps the first thing to consider is what has already been done by others to solve the same type of problem. This is not contrary to the statement in the preceding paragraph; it is always well to know what the state of the art is up to date. Better to start where the other fellow leaves off, than to start from scratch.

Also, one must have a thorough knowledge of the different types of equipment today; of their individual tions; of the ways different types can be combined into systems; and how they can best be applied to the branch of industry concerned. Otherwise, it would be well to get outside assistance.

Engineers of conveyor, crane, monorail, electric truck, and other equipment manufacturers have accumulated valuable stores of knowledge in their respective fields based on experience in working on hundreds of problems. And there is now available the consulting MH engineer whose experience is not limited, and who can make unprejudiced recommendations of the equipment best suited for the particular job.

Application of MH Principles in a Manufacturing Plant

An example of a fine application of MH principles is shown by Fig. 1. Consecutive press operations are done on parts at presses B and E, etc. A large load of blanks in a specially designed box A is brought by fork truck and left on stand S. The operator at press B removes parts from mouth M of box A, puts them in the press. The press discharges them onto conveyor C or if discharge is not automatic, the operator removes the parts from the press and drops them on C.

Conveyor C elevates the parts to box D, and the second operator repeats the cycle at press E. Conveyor F elevates the parts to a third box G, etc. At the end of the line, the last box, when filled, is removed by fork truck to machining, plating or other operations.

Note how parts are handled in large lots at both beginning and end of the line, but at press operations the parts are handled individually. All handling is mechanized, work is kept off the floor and kept moving.

In usual punch press, drill press, etc., operation the procedure is to have a load of unfinished pieces in an empty oil drum. At each machine the operator reaches into the barrel for a part, puts it in the machine, which discharges on the floor, or the operator removes the part and drops it in another drum.

Sometimes workers almost disappear reaching for the parts in the bottom of the barrel. Parts on the floor are picked up or shoveled into drums that are rolled manually, or, moved by two wheel hand truck to the next operation. This is also the method used for delivery to the original machine. The moving is done by the press operators, who also hunt for the raw stock.

Contrast between the two methods of handling shows obvious advantages of the mechanized system. Look around, there are places in *your* plant, even if MH is highly mechanized, where opportunities exist for similar improvements. And, for those who are just beginning to take advantage of modern MH methods, start at receiving and go straight through the shop.

A Few General Principles

1. Eliminate Manual Handling Wherever Possible. When a high percentage of a machine operator's time is spent in handling the tools, his productive output may be increased by mechanized handling. But this is not always true, it may just give him more idle time without increasing his output.

2. Avoid Rehandling. That is, see if the work can be done in one handling operation instead of two or more.

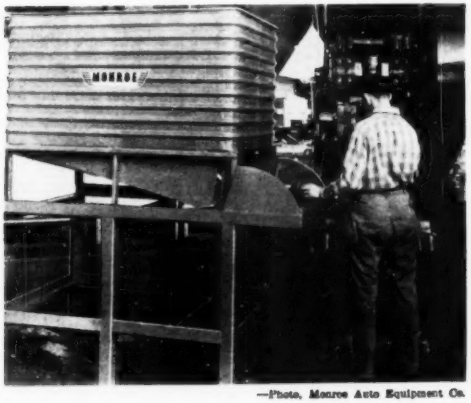
3. Use Handling Equipment Which Sets a Uniform Pace for the Workers. This can be done without objectionable "speed-up," and is especially good in assembly operations. In one case, assembly conveyors whose initial cost was $100,000, saved 80,000 man hours per month, and increased output almost 10 per cent. In another case, a $2500 final inspection conveyor for auto thermostats allowed four operators to turn out more work with less effort than was previously done by eight.

4. Handle in Large Lot Units (unit loads). This is especially important at receiving, shipping, in storage, and for transportation between departments. Inside a department, or between machine operations it may be better to handle parts as individual pieces. This point is further details in other paragraphs.

5. Make Plant Area More Effective. Use overhead spaces as mentioned in the intangible benefit. "Better utilization of plant."

6. Keep It Off the Floor.

7. Keep It Moving.



—Photo, Monroe Auto Equipment Co.

Fig. 4. Close up of special box which feeds parts to the operator always at the same point and at the proper height

Flow Process Charts As Used in MH Problems

By H. B. MAYNARD, President, Methods Engineering Council

Proper analysis and systematic use of pertinent data and facts facilitated by use of flow process charts . . . Typical MH questions . . . Example of chart use where changes cut handling costs 30 per cent . . . Pointers for use and application . . . A must for cost reduction ideas

ALMOST ANY materials handling problem can be quite easily solved if the problem itself is clearly stated. Materials handling problems in themselves are usually not difficult, but they are often surrounded by so many variable factors that the solutions are not readily apparent.

Thus when the solutions cannot be reached by the equivalent of "mental arithmetic," there is a tendency to believe that the problem itself is complex, whereas it is merely a matter of setting down readily ascertainable facts, using a common unit, and then by simple addition, subtraction, multiplication, and division arriving at the answer.

The flow process chart is an extremely useful device for stating manufacturing problems so clearly that a logical solution becomes apparent. Flow process charts do not themselves solve problems, but they present problems so clearly that the investigator can reach the correct solution without difficulty. In other words, showing on a flow process chart the fact that a certain part must be moved 1000 ft between two operations will not reduce handling time.

The layout of the plant itself must be changed before the distance traveled will be reduced. At the same time, the flow process chart will help to bring out clearly the excessive distance moved and will tend to point out to the investigator the desirability of doing something to improve the situation.

A flow process chart may be defined as a graphic representation of the sequence of all operations, transportations, inspections, delays, and storages occurring during a process or procedure. It also includes information desirable for analysis such as time required and distance moved. A flow process chart is not difficult to prepare and may be made by anyone who has familiarized himself with a few standardized procedures which have been developed by a committee working under the auspices of the American Society of Mechanical Engineers.[1]

The flow process chart shows the different steps of a process such as operations, inspections, distance traveled, cessations of travel, time required for each step, and any other pertinent information the one who is drawing it may wish to show. It presents a picture of a number of variable factors in such a way that their relationships to one another may be readily understood.

In using a flow process chart to solve a materials handling problem,

[1] ASME Standard-Operation and Flow Process Charts—ASME Special Committee on Standardization of Therbligs, Process Charts, and Their Symbols—ASME, New York, 1947.

METHODS ENGINEERING COUNCIL FORM 112

FLOW PRO

IDENTIFICATION

SUBJECT CHARTED: Receiving Operations at XYZ Warehouse
DRAWING NO. _____ PART NO. _____
POINT AT WHICH CHART BEGINS: Receiving Elevator -- 11th Floor
LOCATION _____
POINT AT WHICH CHART ENDS: Shipping Elevator or Stock Bins
LOCATION _____

CHART NO: II
TYPE OF CHART: Material
SHEET NO 1 OF 2 SHEETS
CHARTED BY: C. E. S.
DATE: October 13, 1947
APPROVED BY: H. B. S.
DATE: October 30, 1947

QUANTITY INFORMATION

1 Skid = 15 carton average (Basis 150 skids) 1 Shipment = 3 Cartons
1 Carton = 20 boxes 1 Marking Truck = 4 Shipments
1 Box = 3 pieces 335 Shipments per day
1000 Cartons = 1 day's receipts
or 60,000 pieces marked per day

YEARLY PRODUCTION: 255,000
COST UNIT: Carton

PRESENT METHOD

QUANTITY UNIT CHARTED	SYMBOLS	DESCRIPTION OF EVENT	DIST MOVED IN FEET	UNIT OPER TIME IN hrs.	UNIT TRANSP TIME IN hrs.	UNIT INSPECT TIME IN hrs.	DELAY TIME IN hrs.	STORAGE TIME IN hrs.
1 Skid		Stored on elevator on dock					.3000	
1 Skid		Pulled to receiving well and returned to elevator	130		.0010			
1 Skid		Held for processing					2.0000	
1 Carton		Examined for destination (Dept.)		.0005				
1 Carton		Carried from skid to department skid or truck	4		.0018			
1 Skid		Held for a load					.0375	
1 Skid		Attached pulling handle and maneuvered to open area			.0003			
1 Carton		Delivered to checker (2 men) and return	180		.0087			
1 Skid		Detached and piled skid on skids			.0002			
1 Carton		Positioned to open (search)	10	.0063				

the first step is to chart the present procedure accurately and completely. Each event portrayed on the chart is then questioned closely. The first question invariably asked is, "Is it necessary?" Unnecessary work is frequently uncovered as the result of process chart analysis. If the event is necessary, then questions are asked which are designed to suggest better ways of doing it.

Typical materials handling questions are:

1. Can the work stations for the successive steps of the process be moved close together and materials handling accomplished by means of gravity chutes?
2. Is a conveyor justified?
3. If so, what type would be best suited to the job?
4. Should electric trucks be used?
5. Should special racks or trays be designed to permit handling the material easily and without damage?
6. Can material be dispatched from a central point by means of a conveyor?
7. Is the size of the material container suitable for the amount of material transported?
8. Can scrap or waste material be handled more effectively?

When these and similar questions are asked with an open mind, possibilities for improvement are almost always uncovered. The next step then is to visualize the process as it would be if the improvements were adopted and make a flow process chart of the proposed method. When time and cost figures are added to the chart, the feasibility of installing the improvements is at once apparent.

The illustration is a portion of a flow process chart made recently during the course of a materials handling study, shows how this procedure is applied. The process studied consisted of the receiving activities performed in a large warehouse. The present process was first charted on the left hand side of the form. The things that happened to a carton from the time it was unloaded from a delivery truck beside the receiving department elevator until it was placed by the shipping elevator or by the stock bins were shown together with distances moved and time taken.

Each step of the process was then questioned by the investigator. At length, he decided that instead of performing all handling by trucks and skids, the introduction of a conveyor for part of the process might be desirable. He visualized the process as it would be if the changes were made and charted the proposed method on the right hand side of the form.

Finally, he summarized the information shown on the two charts, using the space provided for the purpose in the upper right hand corner of the form. The summary shows that under the proposed method, the operations would be reduced from 20 to 16, the transportations from 16 to 12, the delays from 7 to 4, and the distance traveled from 1679 to 492 ft. Most important of all, the unit cost would be reduced from $0.5226 to $0.3685.

With an activity of 225,000 cartons per year, this would mean a total yearly saving of approximately $39,000. Since the proposed changes would cost only $18,000, this would mean a net first year saving of $21,000. This is obviously attractive, and the proposed changes were accepted immediately by management without question. Had someone else come up with still another idea for improvement—a by no means uncommon situation—a process chart analysis of his proposal would have quickly proved its value.

So useful is the flow process chart as a tool of analysis that no one who is interested in solving materials handling problems should fail to learn how to use it. It is simple enough to be used by technician and nontechnician alike. Results which it will obtain in the form of cost reducing ideas make its utilization a MH must.

CESS CHART

SUMMARY

TOTAL YEARLY SAVING—DIRECT LABOR		PRESENT METHOD		PROPOSED METHOD		DIFFERENCE	
$39,000	UNIT COST DIRECT LABOR & INSP.	.5226		.3685		$.1541/ct.	
	DISTANCE TRAVELED IN FEET	1679		492		1163	
INSTALLATION COST OF PROPOSED METHOD		NO.	TIME IN hrs.	NO.	TIME IN hrs.	NO.	TIME IN hrs.
$18,000	○ OPERATIONS	20	.3100	16	.3065	8	.0035
	⇨ TRANSPORTATIONS	16	.3028	12	.1388	5	.1640
ESTIMATED NET SAVING—FIRST YEAR	□ INSPECTIONS						
$21,000	D DELAYS	7	6.3875	4	3.7000	3	2.6875
	▽ STORAGES						

PROPOSED METHOD

QUANTITY UNIT CHARTED	SYMBOLS	DESCRIPTION OF EVENT	DIST MOVED IN FEET	UNIT OPER TIME IN hrs.	UNIT TRANSP TIME IN hrs.	UNIT INSPECT TIME IN hrs.	DELAY TIME IN hrs.	STORAGE TIME IN hrs.
1 Skid	○⇨□D▽	Held on elevator or dock					.2000	
1 Skid	○⇨□D▽	Pulled to receiving well and returned to elevator	130		.0010			
1 Skid	○⇨□D▽	Held for processing					1.5000	
1 Carton	○⇨□D▽	Carried from skid to conveyor	4		.0018			
1 Carton	○⇨□D▽	Carried on conveyor to receiving desk	30		(.0030)			
1 Carton	○⇨□D▽	Examined for department number and theft		.0005				
1 Shipment Papers	○⇨□D▽	Searched for in files		.0030				
1 Shipment Papers	○⇨□D▽	Placed with carton on conveyor			.0005			
1 Carton	○⇨□D▽	Carried on conveyor to checker	50		(.0050)			
1 Carton	○⇨□D▽	Opened and packing slip removed		.0050				

Depreciation and Obsolescence Factors Affecting MH

Calculated savings as influenced by fixed charges or capital expense . . . Depreciation and obsolescence as elements of indeterminate cost . . . Disadvantages of under and over estimates . . . Depreciation reserves vs. renewal reserves . . . Six methods of calculating depreciation . . . Short life items treated as expense . . . Replacement policy . . . Insurance and interest . . . Taxes and effect on calculated savings . . . Depreciation and expense as influenced by Treasury Department . . . Employment of gross savings as basis of engineering reports

By B. W. WHITEHURST, Industrial Engineer,
Stone & Webster Engineering Corp.

PRIMARILY THE OBJECT of mechanical handling equipment is to make money for the owner. It saves manual labor and reduces pay roll expense. For example, a car loading device may enable one man to perform a job which previously required four. If the three men no longer needed were paid $2,000 per year each, (including pay roll insurance and taxes) a gross pay roll saving of $6,000 per year would result.

Maintenance, lubrication, power when required, and other expenses cut into this gross saving. If the total expense, other than labor, amounts to $1,000 a year, this must be deducted from the gross saving of $6,000 in pay roll expense. This results in a net reduction of $5,000 per year. Even this substantial saving does not prove that the purchase of the equipment was a sound investment. Its cost is a *Capital Investment* and when the money is spent for plant or equipment the effect of *Capital Expense* or *Fixed Charges* must be considered.

Suppose the equipment cost $10,000 completely installed. The plant value is increased by that amount, and this immediately incurs an increase in taxes and insurance. Also, the owners are entitled to some return on the added investment.

All of these charges, however, are relatively small and should not exceed $1,000 to $1,500 per year, still leaving a saving of $3,500 to $4,000 a year, were it not for the fact that the equipment will *wear out*. That is, we still have to allow for *depreciation* and this may be the critical factor in determining the soundness of the investment required.

If the equipment will wear out in two years, requiring a $10,000 replacement every second year, obviously the saving of $3,500 to $4,000 a year on other items is insufficient to produce a net return on this investment. On the other hand, if the useful life of the car loader is 20 yr, and the $10,000 investment recurs only after this long interval, then the net savings are substantial, at least 30 per cent on the original investment, and the purchase of a car loader is a wise expenditure. Obviously, this factor of depreciation is a major one in determining the economies of a proposed installation of materials handling, or any other kind of equipment.

Depreciation, the actual wearing out of equipment, is not the final consideration in determining fixed charges. There is another hazard to the owner's profit. Long before the car loader is worn out, a new device may be invented, capable of loading five times as many cars in a working day. With the new device, one man and one piece of equipment does the work of five men and five machines of the older type. The old car loader is now said to be obsolete, and we have this added factor of *obsolescence* to consider in computing fixed charges.

Depreciation is a relatively determinable factor. Experience indicates that a certain type of rubber belt in a definite kind of service will last 3, or 5, or 10 yr, and a reasonably accurate allowance may be made for depreciation. However, no one can predict how long it will be before some new device is developed which will render the belt obsolete or the machine it is a part of, or even the entire plant in which it is installed. Judgment of the highest type, and long experience in the particular industry involved, is required to determine a proper allowance for obsolescence.

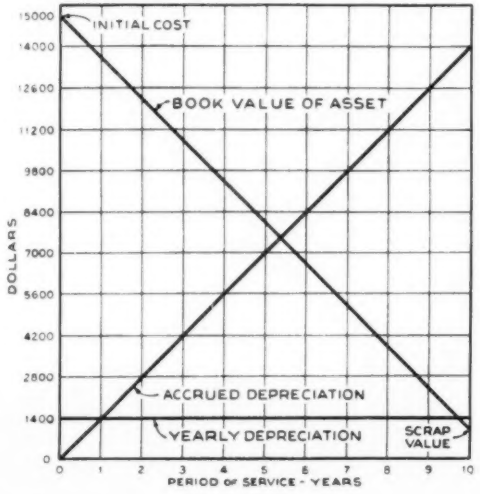


Fig. 1. **Straight line depreciation is the most widely used method. These curves are drawn for equipment costing $15,000 with a scrap value of $100, and an expected life of 10 yr**

Depreciation

The proper classification of handling machinery and associated

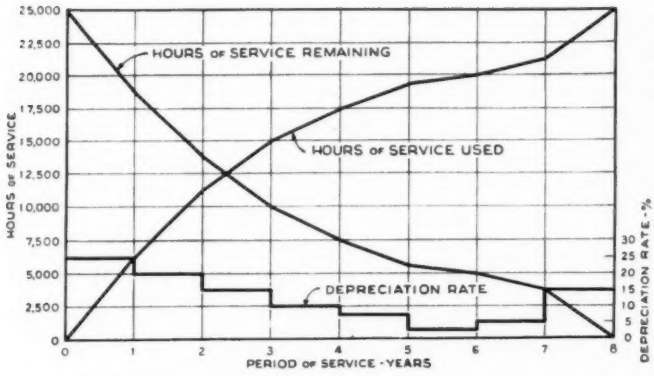


Fig. 2. The machine hour method of depreciation is based upon use during a given period. The curves above are drawn for a conveyor belt with an estimated life of 25,000 hr and operation as tabulated in Table I

equipment is essential and often troublesome. Under the caption "Machinery" one may include everything from electric motor drives to small power tools, under the caption "Equipment", everything from an industrial tractor to a storage battery. The estimated useful life of these may vary from less than a year to more than 30 yr.

In fact, it has been contended that a *properly maintained* plant never wears out, and its life is infinite. It is usual in industrial accounting practice, however, to assume some definite life for individual items, or groups of items, and thus, in addition to proper classification, the depreciation rate of each item should be determined separately.

Need for determining reasonable depreciation rates becomes increasingly important to satisfy State and Federal tax requirements.

Machinery depreciates at a certain rate if operated full time, less rapidly if operated part time. Actual depreciation is small during the beginning of operation of a new machine and large near the end of its usefulness. Adequate and proper maintenance can prolong the useful life of equipment whereas improper maintenance can increase the rate at which it depreciates.

Assuming that the amount of maintenance required may increase as the equipment ages, the depreciation charge should decrease annually and a depreciation allowance may be provided that will increase annually. Usually the asset value of the equipment and the depreciation reserve charge vary inversely to each other.

It is recognized that there is no accurate means of determining the life expectancy of the various types of MH equipment. Some of the numerous factors affecting the life expectancy and materially increasing depreciation are: 1, using a machine in a manner for which it was not designed; 2, overloading; 3, improper maintenance; 4, wear and tear; 5, required replacement due to improvements in the arts; 6, inadequacy to meet growth of business; 7, obsolescence; and 8, unusual deterioration.

In estimating depreciation, the factors that must be taken into consideration are: 1, the original cost of the equipment, which should include freight, installation and other incidental expenditures, including all discounts and allowances. 2, the second-hand resale or the scrap value of the equipment that may be recovered as an asset after it is taken out of service. If this is estimated as scrap, it should be net after the cost of dismantling is deducted. If a piece of equipment is to be retired from service within a short period of time, its present value as second-hand equipment may be determined by appraisal. 3, the estimated life expressed in units of time. This is a variable and is affected by the duration and intensity of operation and the degree of maintenance afforded.

These factors should add up to a reasonable cost to be depreciated. Failure to include all of the above charges effects an understatement of original cost and results in placing a part of future operating cost on the period in which the machinery or equipment was purchased.

Where plant costs are based on nominal values that are in excess of a reasonable cash value, the operating costs will be overstated. Overstatement of original cost may occur where machinery and equipment are acquired through installment purchase contract or through trade-in.

All things considered, the many factors that influence depreciation, and to a large degree obsolescence and replacement, result in the whole process being speculative.

There are six accepted methods of estimating depreciation that are applicable to MH equipment. These are: 1, the straight line or percentage method; 2, the machine hour method; 3, the production output method; 4, the sum of years' digits method; 5, the sinking fund method; and 6, the appraisal method.

The Straight Line Method

Of these six, the most used and simplest is the straight line or fixed percentage method which assumes that the rate at which the machine depreciates will be uniform during its useful life. This method approximates closely the actual depreciation indicated by more complicated methods. The procedure is to find the difference between the initial cost and the scrap or resale value and divide the difference by the number of years the equipment is expected to be of service. The result obtained is the depreciation charge per year. This may be calculated from Eq. 1 & 2.

Where

C = Cost plus total installation charge—Assumed $15,000

S = Resale or scrap value after dismantling—Assumed $1,000

L = Expected service in years—Assumed 10 yr

U = Charge per year

$$U = \frac{C - S}{L} \qquad \text{Eq. 1.}$$

Inserting the assumed values gives

$$U = \frac{\$15{,}000 - \$1{,}000}{10 \text{ years}}$$

$$= \$1{,}400 \text{ annual depreciation}$$

This method, based on the above values, is illustrated by Fig. 1.

The Sinking Fund Method

The sinking fund method is frequently used in the precalculation of fixed charges on a proposed investment. This method assumes that annual payments into the depreciation reserve earn interest or other return at a predetermined rate. For example, ten annual payments of $1,042, drawing interest at 3 per cent compounded annually, would amount to the required $14,000 at the end of the 10 yr.

This is a more realistic conception of actual requirement for depreciation, since charges to this account are not accumulated in a cash

Table I. Depreciation rates as calculated in the example for the Machine Hour method

A	B	C
Period	Hours of Operation	Depreciation Rate, %
1 yr	6,250	25
2 yr	5,000	20
3 yr	3,750	15
4 yr	2,500	10
5 yr	1,875	7½
6 yr	625	2½
7 yr	1,250	5
8 yr	3,750	15

box or vault, but are invested, or more usually used in the conduct of the business. In the latter case, depreciation reserves are earning a return equal to the average return on all capital invested in the business.

The Machine Hour Method

The machine hour method apportions the depreciation to the hours of operating life at the end of each period or year. As the piece of equipment may be in operation a varying number of hours each period, the depreciation will vary in direct proportion, that is the depreciation rate in percent

$$= \frac{\text{hours of operation per period}}{\text{expected service in hours}} \quad \text{Eq. 2}$$

Assume a conveyor belt has 25,000 hr of useful life and that at the end of each year the hours of operation are as shown in Column B of Table I. Then by applying Eq. 2 the depreciation rate will be as given in Column C. The depreciation rate based on the above assumption is also shown graphically by Fig. 2.

The Production Output Method

If, instead of hours of operation in the above table, we assume the belt will handle 25,000 t of material, the depreciation rate will be the same, that is the depreciation rate R is

$$A \div B \qquad \text{Eq. 3}$$

Where

A = tons of materials handled per period

B = Expected life in total tons of materials handled

This is the basis of the "production output" method.

These two methods overcome many of the objections of the regular straight line method in that the depreciation rate is a function of useful service and makes allowance for fluctuating plant operations.

Sum of the Years' Digits Method

The sum of the years' digits method provides for a yearly reduction in the depreciation rate over the preceding year. The annual depreciation charge is obtained by multiplying the initial cost by a fraction whose denominator is obtained by adding together the digits of the years of life: the digits for five years' expectancy would equal 1+2+3+4+5, or 15; for ten years, the sum of the digits equals 55.

The digits in the reverse order are used as the numerator. Suppose an industrial tractor used for hauling trailers cost $3,500, has a life expectancy of 5 yr and a scrap value of $500. The yearly depreciation charge would be as shown by Table II. Figure 3 has been prepared from the values given in Table II.

The Appraisal Method

The appraisal method determines the depreciation rate for each period by visually observing the equipment and by comparing inventories taken at the beginning and end of each period. The method is more applicable to short-lived assets than to long-lived equipment.

Short Life Items

Many items such as certain conveyor belts, tires, truck batteries, etc., fall into a special class because their life span is short and can not be predicted accurately. With these and similar items, obsolescence is rarely realized. Their repair and maintenance cost is high and over an extended period cost many times the initial value of the item, resulting in most instances in an exceedingly high rate of depreciation. It is sound practice to regard the replacement of such items as expense and not as a fixed charge.

Obsolescence

Two principal forms of obsolescence are recognized. First that brought about by some radical changes in design. While this type can not be predicted prior to its occurrence, it does not mean that the equipment is valueless and must be discarded. Rather, it indicates that a point is reached where its use beyond an estimated future date will be unprofitable.

The second form is a gradual reduction of usefulness due to the accumulative effects of small improvements and changes introduced over a number of years. Where this type exists it can be anticipated when, in the future, it will no longer be profitable to operate.

Obsolescence implies the retirement or replacement of machinery or equipment before its useful operating life span has been utilized, that is, there is, still productive capacity available. The relation of depreciation to obsolescence is important in that depreciation should cover losses of predictable obsolescence.

Table II. Depreciation rates calculated for an industrial tractor using the sum of the years' digits

Expected Service In Years	Fraction x	Initial Cost Less Salvage	=	Yearly Deprec. Charge
1	5/15 x	$3,000	=	$1,000
2	4/15 x	3,000	=	800
3	3/15 x	3,000	=	600
4	2/15 x	3,000	=	400
5	1/15 x	3,000	=	200

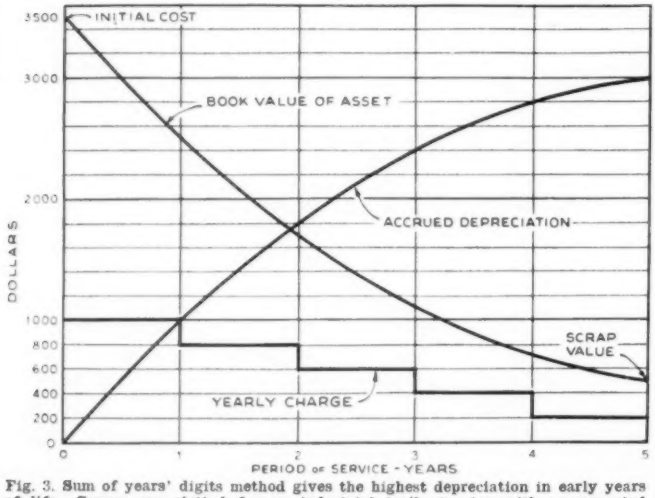


Fig. 3. Sum of years' digits method gives the highest depreciation in early years of life. Curves are plotted for an industrial trailer-tractor with an expected life of 5 yr and a cost less salvage of $3000. Depreciation calculations are given in Table II

Replacement

Depreciation charges may provide funds for replacing worn out and obsolete machinery and equipment, enabling the plant's producing rate to be maintained without requiring new capital. Thus depreciation charges should be such as to maintain the plant's output and not necessarily the dollar value of the equipment.

It should be recognized that the usual method of depreciation accounting is not designed to finance

Table III. Acceptable depreciation rates for a few types of materials handling equipment

Equipment	Years Useful Life	St. Line Deprec. Rate, %
Steam shovels	5	20
Trucks gasoline, light		
Chassis	8	12.5
Body	4	25
Engine	6	17
Trucks electric, light		
Chassis	10	10
Body	5	20
Motor	6	17
Trucks gasoline, heavy		
Chassis	10	10
Body	8	12.5
Engine	6	17
Trucks gasoline-electric, heavy		
Chassis	10	10
Body	8	12.5
Engine	6	17
Motor	6	17
Tractors, gasoline, industrial	7	14.3
Tractors, electric, industrial	8	12.5
Trailers, industrial	8	12.5
Hand trucks, 2 wheel	20	5
Hand trucks, 4 wheel	15	6.7
Low lift trucks, hand operated	12	8
Low lift trucks, motor driven	8	12.5
High lift trucks, motor driven	6	17
Low lift fork trucks, motor driven	12	8
High lift fork trucks, motor driven	8	12.5
5 Ton locomotive, gasoline	8	12.5
5 Ton locomotive, steam	10	10
Package conveyors, belt		
Foundations	50	2
Structures	33	3
Idlers and pulleys	10	10
Flat belts, handling cans	10	10
Flat Belts, handling cartons	15	6.7
Bulk materials conveyors		
Idlers and pulleys	10	10
Trough belts, flour	7	6
Trough belts, sugar	15	6.7
Trough belts, grains	10	10
Trough belts, coal, stone, etc.*	50	20
Screw Conveyors		
Coal, high sulphur	2	50
Coal, low sulphur	8	12.5
Linseed, seeds	20	5
Flour	20	5
Sugar, crystals	5	20
Elevators		
Belt type	10	10
Chain type	10	10
Large motors	25	4
Small motors	15	6.7

* Based on the formula

$$Y = \frac{w^2 \times L \times 700}{d \times h \times t \times 100}$$

Where
Y=Expected useful life in years
w=width of belt in inches
L=length of belt in feet between end pulley
d=operating days per yea.
h=operating hours per day
t=tonnage conveyed per hour
700 and 100 are constants

the purchase of new equipment but rather spread the cost of the existing equipment over the established life expectancy period.

Presently, however, there is a definite trend among some of the strongest industrial enterprises to increase annual payments to the depreciation reserves, in order to take care of increasing costs, and to create a fund which, at the end of the equipment's useful life, will be sufficient to replace it at the higher cost then existing. Such a fund is more properly called a *renewals reserve* than a *depreciation reserve*.

Just when to replace a machine or a piece of equipment is a constant problem. Machines usually have a longer life span than equipment. Some of the reasons for replacements are that the equipment is worn out or obsolete, has insufficient capacity, or has excessive maintenance cost. New equipment usually is more efficient, requires less maintenance and will handle more volume than existing equipment.

At times, it may be advisable to retire MH equipment to storage with a view either to disposing of it when market conditions are more favorable or of restoring it to service at a later date. In these cases, the book value should be removed from the *depreciation reserve* or *renewals reserve* accounts and the net salvage value charged to an *abandoned equipment* or similarly titled account. Later, if returned to use, the existing secondhand value of the equipment, may be used as the replacement value.

Suppose an industrial tractor, initially costing $5,000, is retired after 4 yr of service because increased plant production requires a tractor with greater pulling power. At a yearly depreciation rate of 16.7 per cent, the asset has depreciated in the amount of $3,340. The net ledger value is now $1,660.

If the engine or motor was replaced with one of larger horsepower, at a total cost plus installation and incidental charges of $340, the net ledger value then amounts to $2,000. However, an investigation of the market may reveal that a reconditioned tractor with equivalent pull will cost $3,000. This latter figure becomes the replacement value with a new life expectancy and a new depreciation rate.

Management should establish a policy of plant handling machinery and associated equipment replacement. In considering such a policy, the following are some of the items that deserve attention: estimated cost and life of the proposed machine; expected salvage value of machine to be replaced; yearly expected benefit; yearly net profit and yearly average investment.

Machine and equipment performances should be studied and a comparison made of all significant facts so that an intelligent decision can be made as to whether the purchase of new machinery can be justified. Obviously, the reasons for replacement are to reduce costs, to reduce danger and accident hazards and to increase revenues.

As depreciation and obsolescence are continuous, replacements must be made or the production efficiency will drop lower and lower compared to plants having modern equipment. Machines may be retired on a scheduled program, instead of waiting until breakdowns demand it or until the existing machine becomes obsolete or inadequate by advances in manufacturing methods and new developments in the machinery field. Machinery may be retired on an annual basis, that is replace each year one or more of the oldest machines still in normal use, or, those that lack capacity, or, have a high maintenance cost, with new improved ones having adequate capacities of lower operating cost.

Assuming a straight line depreciation rate of 10 per cent, replacements could begin when the total cash in the depreciation reserve equals 10 per cent, with a yearly replacement thereafter of 10 per cent of total original cost.

Small tools and equipment that may be lost or stolen may have, under proper condition, a low rate of depreciation but because of their expendable nature they require frequent replacement and should be provided for on a monthly budget.

Insurance and Interest

Only companies financially strong and owning widely distributed buildings and equipment should consider carrying their own insurance, that is, setting aside a sum of money or equivalent to cover adequately any loss incurred. Where private insurance is deemed advisable, the value of the plant equipment and machinery, buildings and other property should be determined by a reputable appraisal company.

Such an appraisal should supply detailed schedules of each property and machine item, the estimated net value and the cost to replace in working order. This procedure is also acceptable in most cases by standard insurance companies.

Standard insurance policies stipulate the maximum to be recovered as the cash value of the property destroyed, or the cost to replace or repair it. That is, whether a policy covers fire, depreciation or property damage, the maximum one can col-

lect will not exceed the cost of repairs or the replacement value.

The premium for insurance covering plant equipment may be charged to the operating cost of the machine or to the department.

Proper allowance for interest varies from one industry to another and from one company to another within the same industry. It may be taken as the average interest which the owner pays on borrowed money or funded debt, or, it may be taken as the average rate of return to the stockholders. Frequently, in the mind of management, it may be considered as the profit which could be earned by some other form of investment. This is a difficult concept to express numerically and is seldom used by plant accountants.

Taxes

The ever increasing burden of taxes merits a keen interest in this important subject. Real and personal property taxes and pay roll taxes on salaries may be charged to operating expenses. State and Federal income taxes and excess profits taxes are chargeable to net company income. Savings effected by equipment installations, if they are true savings, increase the owner's net profit, and thereby increase his income tax.

Any computation or approximation of the effect of income tax on any particular installation is generally impracticable; nevertheless, management usually discounts the *savings* computed by the engineer in the light of increased taxes. State and Federal tax regulations require that depreciation allowance be considered in terms of specific units or items, or, in groups of similar pieces so that the initial cost, depreciation and estimated life may, for each, be determined.

In preparing depreciation schedules for tax purposes, it is required to show for each depreciation reserve account the credits and charges in each prior year and the depreciation reserve at the beginning of the current year; the items retired, sold, abandoned or destroyed; the basis of arriving at fully depreciated assets, and depreciable equipment acquired for other than cash.

The Securities and Exchange Commission requires of income tax registrants statements of operating expenses, among which are shown property and equipment additions, depreciation, depletion, obsolescence, retirements, maintenance and repairs, taxes (other than income and excess profits), royalties, rents and management, and service contract fees.

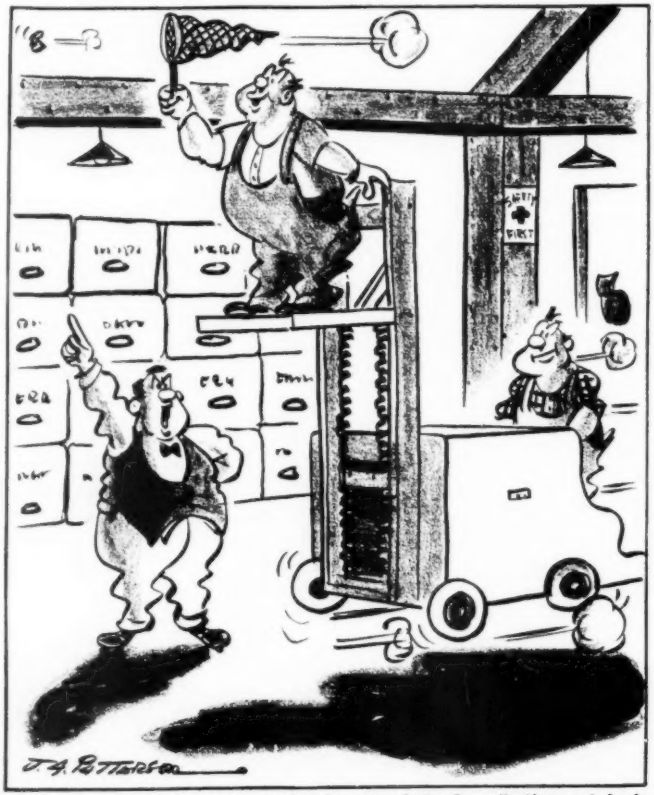
An important aspect of depreciation is the allowable deduction in Federal income taxes permitted by the U.S. Treasury Department. The burden of proof of depreciation deduction is the responsibility of the taxpayer.

The Treasury Department permits allowance in Federal income tax returns for wear and tear, depreciation and obsolescence. The allowable depreciation deduction under Federal laws is exceedingly technical with many modifying rules and regulations. The accepted basis for computing depreciation is the same as that used for computing net profit or gain from a sale. The estimated useful life of the equipment is used as the basis for determining the depreciation rate. For income tax purposes, the depreciation base is usually initial cost less salvage value.

In computing the tax, the straight line method which provides for deductions at a uniform rate per year is generally used. However, income tax regulations permit the use of any recognized method of depreciation such as the diminishing value method, the unit production method, and, the sinking fund method. As each of these methods establishes an annual charge over the estimated useful life of the machinery or equipment, the income tax regulations are complied with.

The MH engineer should have a complete understanding of fixed charges, but it is best for him to ignore them in making recommendations to management. If the engineer can compute accurately the *gross saving* effected by a particular installation, that is the *net reduction in operating expense*, then the management can judge with some precision whether or not the proposed installation is an attractive investment. This may be done by the manager's own rule of thumb, or it may be turned over to a group of accountants who will prepare pro forma accounts disclosing the effect of this new installation on every operation in the plant.

While savings are frequently the sole justification for the installation of modern materials handling equipment, an increase in production from existing plant and equipment is often a more important consideration. When this is achieved, the calculation of the effect on fixed charges for the whole plant is a truly formidable problem, and one which only the plant accountants could be expected to solve. A simple statement of gross savings, from which the owner may deduct whatever fixed charges he sees fit, is therefore the safest and most satisfactory basis for an engineering report.



"To blazes with that special species for your butterfly collection—get back to work!"

Sell Top Management on Materials Handling

By JOHN F. ROBERTS, Central Planning Dept., Ansco Div., of General Aniline & Dye Corp.

Engineering and planning a project study . . . Differences in interdepartmental and plant wide projects . . . Talk management's language —reduction of labor, utilization of space, lower costs and return on investment . . . Use of visual aids—motion pictures, slides and three dimensional models, all of these help in selling management on MH

REGARDLESS of how nobly conceived or systematically devised, a proposed system of handling will never materialize unless management's approval is forthcoming. The importance of selling management on materials handling cannot be over-emphasized.

Although management is extremely cost conscious, it does not necessarily follow that management recognizes modern MH as a potential source of substantial cost reduction. Nor can the fact that management is not MH conscious be blamed upon management in all instances.

It may just so happen that industrial engineers, staff technicians, department and section managers and supervisors have never forcefully called attention to the fact that MH is a vital factor in cost reduction, at a time when management, faced with rising material and labor costs, is sincerely trying to check the inflation spiral by holding the line on prices.

In brief, it is a profound responsibility of engineers to insure that management is aware of the potential savings to be effected through the acceptance and installation of modern handling equipment and techniques in order that the most profitable allocation of available capital be achieved.

To do this, it is necessary to talk management's language — namely, cost reduction and savings.

Once the mechanics of a proposed system have been determined, the necessary capital expenditure required to achieve installation must be determined. Operating costs of existing materials handling operations must be dissected and thoroughly analyzed. In addition, operating costs of the proposed system must be projected.

A comparison of existing costs with proposed costs should then be made. It is at this point that the planning engineer will be able to evaluate finally the system proposed, determine the savings to be realized, and decide what the possibilities of acceptance by management will be.

When the materials handling engineer is firmly convinced that the savings to be realized justify presentation to management, the most effective and appropriate method of presentation must be determined.

Regardless of the scope of the project at hand, if savings are anticipated, a detailed report summarizing the savings to be realized must be prepared expressing as dramatically as possible in the terms most dear to the hearts of management, that is

1. **Per cent reduction in personnel**
2. **Per cent reduction in storage or production space**
3. **Dollars reduction in yearly operating costs**
4. **Dollars required for initial expenditure**
5. **Number of years required for accrued savings to equal or exceed the investment.**

In addition, intangible cost savings and additional benefits to be realized by acceptance and installation of the proposed system must be clearly and forcefully enumerated. Reduction in human fatigue, fewer operational hazards to employes, less damage to materials, improved employe morale, more effective utilization of personnel and compatibility with accepted practices of competitors and industry in general are among the intangible results to be expected.

The most important step still remains. As noted above, the best of plans may prove unavailing unless properly presented to those men responsible for the decision to accept or reject them. It is at this point that the judgment of the engineer must be exercised and the circumstances of the particular company surveyed considered.

If the project is of minor importance, affecting only one department and involving but a relatively small capital investment, it may be considered desirable merely to submit the request for the necessary capital expenditure, supported by the previously prepared detailed project and savings report to management for consideration in the preparation of the following year's capital expenditure budget.

If the project involves the operations of more than one department but represents a moderate capital outlay, a meeting of all parties concerned should be arranged and the proposed system, savings to be realized, etc., discussed in detail. Following approval by all concerned, action should be taken immediately to procure the equipment required as soon as possible.

This will usually entail the submission of a request for capital expenditure, substantiated by project and savings reports through appropriate channels. Generally, management will compare requests of this nature with other demands on available capital and either approve or defer the request until preparation of the following year's capital expenditure budget.

However if the proposed system, such as the installation of a pallet handling system throughout a plant, affects several departments, requires a considerable expenditure for buildings and equipment and presents a marked departure from existing practices, the above procedure must be supplemented with more forceful data, usually in the form of visual aids.

Among the visual aids most forcefully used in connection with materials handling and used successfully by Ansco in the presentation of reports of this nature have been—

1. Motion pictures of existing operations
2. Motion pictures of proposed operations. These are frequently obtained from manufacturers of mechanized handling equipment
3. Colored slides of flow diagrams representing flow of materials or sequence of operations
4. The use of operating three-dimensional models, e.g. model freight cars, fork trucks, pallet loads, trucks, etc.

Once the laborious job of assembling this material has been completed, it is vital that arrangements be made for presentation to top management. If the program is as effective as it has every right to be, the materials handling engineer will be amazed at the intense interest generated by top management.

Following approval of a proposed system by top management, it is extremely desirable to repeat the presentation of the program outlined above to the various levels of supervision which would be affected by the proposed changes, in order that they will be receptive to the installation of the proposed system and thereby contribute to its success.

The foregoing will not necessarily insure acceptance by management of a proposed system but it is guaranteed to make management MH conscious and thereby make the going easier in securing approval for future expenditures of a capital nature for equipment of this type.

MH Cost Control Records for Current and Future Use

Cost control as a factor in good management . . . Costs from the standpoint of the MH engineer . . . Establishing cost centers . . . Types of records for small and large industries . . . Five basic factors in handling costs . . . Seven points of good planning . . . Procurement control and budgeting . . . Operating cost records . . . Maintenance of equipment and salvage . . . Relationship of MH personnel to the cost accountant

By **DONALD W. PENNOCK**, Carrier Corporation

SHORTLY, in the fast approaching consumers market, the American public will decide by *goods selection* whom it will permit to remain in business.

Its decisions, based principally on product prices derived from manufacturing costs, will be merciless. Therefore, no manufacturer can afford to forget that only *one* business in his industry will have the *lowest* costs!

Since a large part of all manufacturing costs are entailed in material handling, cost control applicable to planning, design, procurement and operation of handling equipment, constitutes an important factor in the economic soundness of competitive industries.

Cost control can be achieved effectively by establishment of cost centers in a business. This means that activities of common interest in the business, and, for which various representatives of management are responsible, are segregated. Thus each of these individuals can isolate his costs and determine how much he is spending to discharge his share of the business responsibilities as well as compare his expenditures with the standard amounts he should be expending. The physical means by which he accomplishes these accountings, analyses and comparisons are costs records.

The extent to which cost centers should be established to record handling costs should be governed by the size of the manufacturing operation. In a small manufacturing activity, at a cost center under a superintendent the following can be economically recorded:

1. **Unloading and moving of material into Raw Stores**
2. **Material movement on the Production floor**
3. **Material transfer to Finished Stores**
4. **Material transfer from Finished Stores to the carrier**

Handling costs chargeable against each of the various productive and finished goods areas can then be determined using the material handling labor time expended in the areas as a prorating basis.

In a broad activity, it will be worth record value to establish a material handling cost center for each productive area as well as for raw and finished material areas. Material handling cost centers in broad activities usually warrant control by supervision who devote their entire time to material handling operations.

Handling equipment cost records, like those for any other element of manufacturing, must be gradually developed by modern accounting practices if they are to be adapted universally into our business structure. However, there is presently an overwhelming need for a basis for guiding, recording, and reporting operations pertaining to material handling equipment.

So essential to proper management is this control that it seems logical and timely to offer a general type of records which may be adjusted to the individual requirements and company policies of the average business. The records are presented with detailed suggested information headings for purposes of clarity and to facilitate selection of data for provision of an acounting records system for a specific business.

It is understood that many of the various records listed in this discussion must be an integral part of the general accounting system of a business. The itemized data under each record name has been restricted to those information headings directly pertaining to or necessary in dealing with material handling equipment only. In general practice these information headings should be incorporated with others on the general accounting records of a business.

For brevity, those headings dealing with dates, ordering and authorizing sources, and similar information have been eliminated. The heading *Charge Number* pertains to cost centers. With the above in mind, all records required for current purposes and future cost studies relative to material handling equipment have been grouped under five general headings: 1, Planning; 2, Procurement; 3, Operation; 4, Maintenance; and 5, Salvage.

Planning

The value to a business of any investment in material handling equipment is proportionate to a large extent upon the planning given its conception. This planning should be based on records from which can be computed the expected utilization of the capacity of proposed equipment over a long period of time, and the savings that may be effected by its use. Seven records are listed below. These are prime aids to material handling personnel in envisioning equipment requirements and obtaining funds therefor:

1. **Long-Term Sales Forecast**
2. **Receiving Material Weight Record**
3. **Shipping Product Weight Record**
4. **Cost Center Equipment Expenditure Approximation**
5. **Cost Center Labor Expenditure Approximation**
6. **Equipment Capital and Expense Budget**
7. **Short-Term Sales Forecast**

The Long-Term Sales Forecast is a record of the total business planned by a manufacturer over a comparatively long period of time. This time lapse may range from a few months to several years depending on the business and the industry. Upon this forecast is based the major equipment procurement policies of the business. It is a necessity for orderly resolution of such matters as design of total tonnage capacities of facilities, standardization and integration of equipment and systems, and planning annual purchasing budgets.

Information Headings: Product, Scheduled Quantity of Product, Capacity of Facilities (Product Quantities), Percentage of Facility Capacity Utilized, and, Actual Production to Date.

The Receiving Material Weight Record is usually incorporated in the Receiving and Inspection Record of a company. It notes the individual shipment weights of raw materials and purchased parts received for fabrication into the various products of a business.

Information Headings: Part Number, and, Receival Weight.

The Shipping Product Weight Record is usually a monthly record of the total net or gross shipping weight of each type of product or of all the products as a whole. This and the above weight record are necessities for proper designing of tonnage capacities of individual pieces of equipment and equipment systems.

Information Headings: Product Number, Product Shipping Weight, and, Total Shipping Weight of all Products.

The Cost Center Equipment Expenditure Approximation is a record prepared by the individual who is directly responsible for planning the material handling operation of a business. Using the long-term sales forecast and, when necessary, one or both weight records as a guide, the capital and expense items proposed to effect the required production are listed as annual expenditures for each year of the forecast. Each annual sub-division of the report may be classified in any of the following generally accepted ways which may be best adapted to the business policies: 1, Kind of equipment; 2, Relative mobility of equipment; 3, Nature of material handled; 4, Departments serviced; and 5, Nature of equipment services.

Information Headings: Equipment or System, Description, Estimated Cost, and, Estimated Saving.

The Cost Center Labor Expenditure Approximation is a record which should be prepared by the supervisor who directs the operation of material handling equipment or systems used in his cost center. It, too, depends on forecasts for guidance and notes the number of personnel or labor hours estimated as required to operate the equipment.

Information Headings: Equipment or Systems, and Estimated Personnel Required for Operation.

The Equipment Capital, Expense and Labor Budget is prepared using the Cost Center Equipment and Labor Expenditure Approximations as bases and considering them in terms of profit that may be realized, and, which is required to meet the obligations of the business. This record subsequently becomes the financial guide for procurement and operation of all equipment expenditures except occasional emergency items.

Information Headings: Equipment or System, and, Funds Budgeted.

The Short-Term Sales Forecast is a record prepared from the long-Term Forecast for each product of a business. It uusually specifies a product production run or manufacturing period of one or more months in terms of hours or shifts per day and week. It may be revised comparatively often. This type of record permits planning immediate requirements of handling equipment and concomitant labor for manufacture of each individual product.

Information Headings: Location, Product, Scheduled Product Quantity, Total Scheduled Quantity, Capacity of Facilities, Forecast Product Quantity, Percentage of Facility Capacity Utilized, and, Actual Production To Date.

Procurement

Cost control phases of procurement of material handling equipment, particularly in broad activities, can be simplified for material handling personnel by use of part or all of the records listed below.

1. **Equipment Appropriation Request and Authorization Record**
2. **Purchase Requisition and/or Purchase Order**
3. **Mortgage Record**
4. **Receiving and Inspection Record**
5. **Actual Detailed Cost Record**
6. **Capital Work Order**
7. **Expense Work Order**
8. **Material Requisition**

The Appropriation Request and Authorization Record (based on either long-term or short-term forecasts) is a detailed request for authorization to procure or revise a specific item or system of handling equipment for which funds have been budgeted.

Information Headings: Budget Number, Appropriation Number, Equipment Description, Charge Number, Reason for Procurement, Estimated Cost, and, Estimated Savings.

The Purchase Requisition and/or Purchase Order is a numbered request and a numbered authorization record both of which are used in the actual procurement or revision of specific equipment. Equipment blueprints, specifications, bids and other data may be attached as necessary to supplement information noted.

Information Headings: Description of Equipment, Quantity, Estimated Cost, Appropriation Number, Charge Number, and, Source of Supply (Vendor).

The Mortgage Record insures that the amount of funds allocated on any given appropriation is not exceeded. It is of particular benefit in a broad activity where several persons may be placing charges against a given appropriation. As each financial obligation to be assumed by an appropriation is incurred, its estimated total cost is recorded on the appropriation's Mortgage Record and an up-to-the-minute estimated balance of the appropriated funds is thus maintained. Some of the major estimated expenditures are transferred and noted on the Mortgage Record from such records as the Purchase Order, Capital Work Order, Expense Work Order and Material Requisition. One side of the Mortgage Record should bear an exact copy of the Appropriation Request and Authorization Record as history data.

Information Headings: Amount of Appropriated Funds, Purchase Requisition and/or Purchase Order Number, Work Order Number, Description of Purchase or Work, Estimated Total Cost, and, Appropriation Balance.

The Receiving and Inspection Record is a numbered record listing all information pertinent to the receival of purchased equipment. It provides a basis for accurate initial comparison of the quality and quantity of equipment received with that ordered. Since this record is usually the same as is used to report receival of product material, it also often provides material handling personnel responsible for design of equipment with much indispensable product material data which may not be on record elsewhere.

Information Headings: Original Purchase Order Number, Charge Number, Inspection Description, Inspection Quantity Count, Freight Charges and Equipment Weight.

The Actual Detailed Cost Record is usually the same form as the Mortgage Record except that it lists actual instead of estimated equipment costs. It may also note an accounting journal number.

The Capital Work Order is a numbered record used in issuing instructions for the fabrication and/or installation of capital equipment The back of the Capital Work Order should bear a Cost Summary Outline.

Information Headings (Front): Capital Order Number, Charge Number, Appropriation Number, Drawing Number, Personnel Responsible for Completion of Job, Job Destination, Description of Work, Material Requisitions, Copy Distribution, Department Directed to Perform Work, Time Allocated and Inspection Approval of Work.

Information Headings (Back): Labor, Material, Overhead and Total Cost.

The Expense Work Order is a numbered record used in issuing instructions for rework or relocation of capital and expense equipment or fabrication and/or installation of expense equipment.

Information Headings: Expense Order Number, Material Requisitions, Charge Number, Description of Work Required, Rework Tag Number, Vendor Rejection Tag Number, Scrap Tag Number, Department Directed to Perform Work, Time Allocated, Inspection Approval of Work, Completion Check, and, Acceptance Check.

The Material Requisition is a numbered record used to obtain material to comply with Capital or Expense Work Orders.

Information Headings: Requisition Number, Number of Department Ordering Material, Charge Number, Quantity of Material, Description of Material, Unit Price, Total Cost, Mortgaged, and, Disbursed.

Operation

There are but two records that need be classified as operation records by material handling personnel for purposes of controlling cost of operation of equipment. These records, when provided with information headings as suggested below and when combined with Repairs to Equipment Records, provide a means of breaking down operation costs by individual pieces or classes of equipment, or by cost centers, departments or the business as a whole.

They can be used in conjunction with weight records to reveal cost per pound or ton of material handled by a single piece of equipment or by all the equipment. They offer a means of computing repair costs per hour of equipment operation or per weight of product material handled. In short, from them can be procured usually all the information necessary for the preparation of special comparison reports which management so often needs to plan profitable new business ventures.

1. **Property Record**
2. **Daily Time Ticket**

The Property Record is a detailed record of capital equipment. To facilitate equipment identification many businesses attach a metal tag bearing the Property Number on the piece of equipment for which a Property Record is provided. The Property Record generally consists of a single form printed on both sides and incorporates under several sub-headings such information as equipment description, general accounting, history, maintenance and revaluation.

Information Headings:

1. *Description Section; Description of Equipment.*
2. *General Accounting Section; Property Number, Serial Number, Charge Number, Classification, Department, Building, Floor and Reference.*
3. *Historical Section; Initial Purchase Date, Appropriation Number, Initial Cost, Reserve or Total Depreciation To Date, Unrecovered Cost, Remaining Life, Periodic Depreciation, Sales Price Upon Disposition and Profit or Loss.*
4. *Maintenance and Repair Sect.; Reference, Identification, Labor Cost, Material Cost, Burden and Total Cost.*
5. *Periodic Revaluation Section Reference, Condition, Cost of Reproduction, Depreciation Percentage, Cost of Reproduction less Depreciation and Total Cost.*

The Daily Time Ticket is the record of labor in hours that has been supplied for operation of equipment, or for fabrication, installation, repair, service or salvage of any equipment.

Information Headings: Employee Name, Employee Number, Elapsed Job Time, Department Service Section Number, Employee General Work Classification, Property Number, and, Charge Number.

Maintenance

The Maintenance costs of operation of material handling may be collected by means of part or all of the four following records:

1. **Capital Equipment Daily Work Record**
2. **Expense Equipment Daily Work Record**
3. **Hourly Payroll Distribution Record**
4. **Repairs to Equipment Record**

The Capital Equipment Daily Work Record is used by maintenance personnel to record the time spent on a job pending transfer of this time to Time Tickets by Maintenance Clerks. Small organizations usually dispense with this form.

Information Headings: Property Number, Departmental Location, Type of Job, Time Required, and, Charge Number.

The Expense Equipment Daily Work Record also is maintained by maintenance personnel and is the same form as is used for daily records of work on capital equipment. This record differs from the Capital Record in that service and repair time is grouped by areas rather than assigned to property numbers.

The Hourly Payroll Distribution Record is usually a weekly record of labor in terms of dollars. It is prepared from the Time Tickets by multiplying the hourly rate of pay of each employee by the time shown on his Time Ticket as having been spent on a job. No provision has been made for labor burden on this suggested record. The question of application of labor burden to the time of personnel assigned to operation and maintenance of material handling equipment is a highly controversial issue. If such labor is considered as not contributing directly to the fabrication of the finished product, no earned burden should be considered. In those businesses where the opposite viewpoint is maintained, the Hourly Payroll Distribution Record may incorporate an earned burden provision.

Information Headings: Charge Number, Property or Order Number, Elapsed Time, and, Cost.

The Repairs to Equipment Record is usually a monthly summary of cost data entered on Hourly Payroll Distribution Records. The total costs compiled on this record are transferred to the Property Record for all capital equipment and the Repairs to Equipment Record supplements the Property Record with regard to total costs for all expense equipment.

Information Headings: Month, Department, Charge Number, Property Number or Miscellaneous, Weekly Costs and Total Costs.

Salvage

Material handling personnel require but one record for directing the salvaging of equipment.

The Equipment Movement Request is a numbered record applicable only to relocation or sale of capital equipment. The sale price listed in this record is recorded on the Property Record.

Information Headings: Request Number, Charge Number, Description, Property Number, Present Location, New Location, Reason for Move or Sale, and, Sale Price.

From the Cost Accountant's Viewpoint

Information in this article has been compiled and presented from a material handling personnel standpoint. However, the position of the cost accountant who necessarily analyzes the results of any record system established, must be considered also. A brief discussion is outlined for the cost accountant's use.

A. Establish cost centers for recording of the various elements of cost by their classification.

A cost center schedule of expenses reflecting the cost elements should include the following: 1. Fixed Charges—Depreciation, Pro rata rent for space, Interest on investment and Insurance; 2. Variable Charges—Hourly labor, Salaries, Supplies, Repairs and Payroll Taxes.

B. Determine a rate of earned burden for materials.

A materials earned burden rate should be developed and applied by weight or price factors. It is suggested that the estimated annual expenses of the materials handling cost center for the fiscal period be divided by the forecasted purchases and the resulting rate be used as follows: When materials standards are set, determine the average cost of the raw material plus freight and to this figure add the rate per dollar value of handling costs. The result is the standard cost.

C. Set up general ledger variance accounts.

Create two general ledger accounts as a part of manufacturing variance namely, Materials Handling Expenses and Materials Handling Expenses Absorbed. The bookkeeping for absorption will entail a monthly entry adding to the raw materials account and crediting absorbed burden for the amount resulting from the application of the rate. The difference between these two accounts will determine the correctness of the rate application.

D. Record materials handled by weight or price factors.

Battle For Lower Freight Rate on Empty Pallets Widens

Lower rates encourage palletization with benefits to shipper and carrier . . . In Indiana new "half of fourth class" rates on empty pallets were effective November 24 . . . Michigan P.S.C. hearings started November 23 and continue through December . . . Proponents hope for low rates on both inter- and intra-state shipments between the industrial centers of Michigan, Illinois, Indiana and Ohio as a nucleus

By RICHARD H. MORRIS, Editor, Plant Engineering

KING PALLET, hailed by followers as the greatest advance in mass handling of industrial material since the introduction of the truck, had his day in court, fettered but unbowed. How he serves industry, what he means to production and the millions of dollars spent at his altar, was told to the accompaniment of clanking chains, chains of high freight rates which limit his stride and hamper his movements.

This occasion was Round Two of the progressive fight for lower freight rates on the return of empty pallets in the highly industrialized sections of the Middle West. The bell rang in Lansing, Mich., November 23. Referee: The Public Service Commission of Michigan. Challenger: Specific Motor Freight lines seconded by Michigan industry including General Motors and Ford. Title holder: Miscellaneous Motor Carrier Associations seconded by "Compensatory Rates" a basic concept of the Michigan Minimum Rate Order.

Officially the round is Docket 3094, a petition by seven Michigan truck companies, or motor freight lines, "for modification of orders prescribing minimum rates for pallets, platforms and skids." Hearings continued through December and the decision is expected in January.

The purpose of the petition is "to encourage more extended use of pallets by reducing the freight rate to one-half of the current fourth class rates applicable to 'any quantity' shipments of:

"Pallets, platforms and skids, shipping, old (used): including necessary separators, sides, ends, stakes or standards, detached, KD or flat or folded flat" which are "furnished by or are the property of shipper or consignee and only when returned empty by the carrier who transported them when loaded between the following points." The points listed cover the principal industrial centers of the state.

Action in Indiana

Round One had been won earlier in Indiana. On November 12 the Ind. Mot. Carriers published Sup. No. 26, PSCI-No. TR-21 effective November 24 for a period of one year. This provides one-half of fourth class rates on any quantity shipments between a number of specified points. Rates range from about 30 to 37 ct per cwt. For example, the rate from Anderson to Bedford is 37 ct, from Anderson to Indianapolis 30 ct.

The schedule covers pallets as defined in the Michigan petition but makes no reference to ownership. Following the definition quoted above and ending "folded flat," the Indiana schedule continues ". . . strapped in bundles each package to be marked as to shipper, consignee and destination . . . Rates apply on such pallets, platforms or skids as are being returned to the shipper but only when carrier or carriers to whom such devices are tendered for shipment have participated in a loaded movement of such devices to said shipper."

The Key State

While Indiana may be said to be the start of the main bout, preliminaries have been going on for more than two decades. Pallet proponents waging an uphill fight have had some earlier successes, namely, the lowered interstate motor rates in effect from Chicago to the West, and, intrastate rates on the West Coast.

Michigan, because of its minimum rate order and industrial importance, is a key point. In effect, the Minimum Rate Order sets a rate floor on the premise that each rate must provide revenue for each commodity.

Several witnesses placed the weight of an average truck load of empty pallets at around 12,000 lb with some estimates as high as 17,000 lb. There was, however, more or less general agreement that the needs of both shipper and trucker would best be met by returning small lots, and, that shipment of the empty pallets with miscellaneous freight or as extra topload was both possible and practical. The point as to whether a full truck load of empty pallets under the reduced rates would be profitable was not developed.

Instead the petitioners held steadfast to the thesis that increased use of pallets would benefit both shipper and carrier by: saving labor; reducing delay time to give increased use of transport equipment; reducing loss and damage to material and, promoting personnel safety. Lower freight rates and prompt return of pallets were held to be prime factors in the further application of palletizing practice. The importance of the latter is indicated by estimates which placed one-third of the pallet inventory at each end of the run.

Obviously, palletized shipments save time in loading and unloading. Considerable data were also presented to show that there is also a material reduction in waiting time, due largely to the very human trait of tackling the easier task first and letting the difficult one wait. Specific data indicate that palletization frequently makes it possible to make two trips in the time formerly required for one, or pick up an extra load in the course of a working day.

Less spectacular but more significant, were data submitted by an auto wheel company operating its own trucks. Data cover a month's time with and without pallets. Round trip time was reduced from 14 hr to 11 hr 45 min. This time covers travel and unloading only. Loading time was further reduced from 1 hr 30 min to 10 min.

Detailed Studies

General Motors submitted the most detailed study based on comparable, palletized and loose shipments between the same points. Photographs and data of five case studies are shown by the accompanying illustrations. Palletizing shows an average saving per trailer of 46 min for loading and 3 hr 7 min for unloading. Equally important the total detention time (time the trailer was in the plant) was reduced 2 hr at the loading end and 9 hr 53 min at the unloading end. This time saving averages nearly 12 hr per round trip. Considering the loading, unloading and travel time, the overall savings agrees well with data above, i.e. 15 to 20 per cent for pallets.

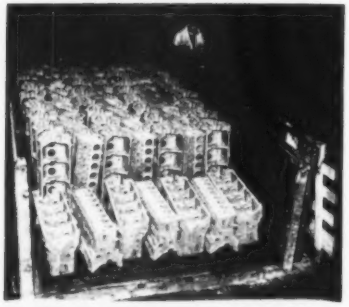
Responsibility of the shipper for delay time in the yard was a considerable point in the hearing. Data on this point were submitted covering all trucks in and out of eight General

← **LOOSE**

Lansing to Pontiac — 251 forgings—gross 24,096 lb
Loading time, 14 min
Unloading time, 360 min

PALLETIZED →

Lansing to Pontiac—5 pallets, 200 forgings—gross wt. 20,150 lb
Loading time, 5 min
Unloading time, 10 min

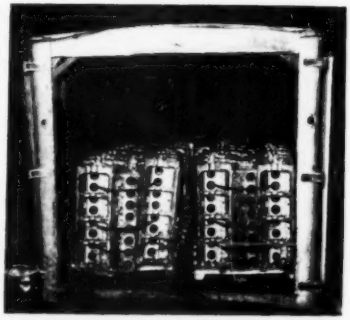


← **LOOSE**

Pontiac to Lansing — 112 castings
Loading time, 43 min
Unloading time, 95 min

PALLETIZED →

Pontiac to Lansing — 12 pallets, 108 castings
Loading time, 12 min
Unloading time, 12 min

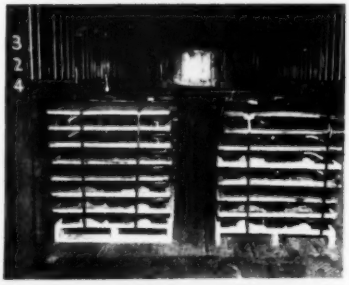


← **LOOSE**

Dayton to Flint — 1470 shock absorbers—gross wt. 20,227 lb
Loading time, 70 min
Unloading time, 165 min

PALLETIZED →

Dayton to Flint—7 skids, 1470 shock absorbers — gross wt. 22,558 lb
Loading time, 30 min
Unloading time, 20 min

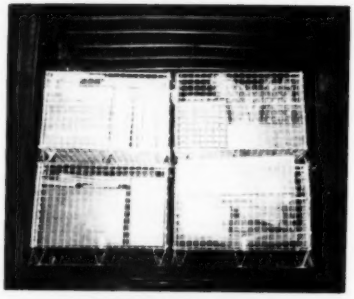


← **LOOSE**

Flint to Detroit — miscellaneous auto parts—gross wt. 21,069 lb
Loading time, 165 min
Unloading time, 375 min

PALLETIZED →

Flint to Detroit—24 pallets, miscellaneous auto parts—gross wt. 20,154 lb
Loading time, 25 min
Unloading time, 50 min



Motors plants for the week of November 30 to December 6 inclusive. Data are tabulated in Table I. Time from checking the vehicle in at the gate until release to the carrier was charged against the shipper. Time from release to checking out at the gate was charged against the carrier.

There is some variation but the percentage of total detention time chargeable to the carrier ranges from 21 to 25 per cent, the overall average being 22.4 per cent. The ratio of the total detention time at

LOOSE (Photo not available)

Flint to Detroit—234 cartons, 936 air cleaners—gr. 8,190 lb
Loading time, 26 min
Unloading time, 62 min

PALLETIZED →

Flint to Detroit—13 pallets, 234 cartons, 936 air cleaners—gross wt. 9,100 lb
Loading time, 20 min
Unloading time, 25 min

loading and unloading check well with the data for the five case studies, i.e. palletized trucks are in and out of the plant in from 35 to 40 per cent of the time required for loose loaded trucks. Opponents said the delay time would probably be reduced by a demurrage charge, but this point was not pursued farther.

Ford Motor submitted data on loading and unloading six trucks, three loose and three palletized. Data checks well with previous data. The loose (some cartons) trucks, totaling 54,169 lb were unloaded in 535 min with 28.835 man hours of labor. The palletized trucks totaling 55,190 lb were unloaded in 52 min with 1.925 man hours. The above includes all time from spotting the truck.

Various data, which check reasonably well, indicate that palletized trucks can be loaded in approximately a tenth of the time required for loose loads and with the expenditure of one-fifteenth of the man hours. Loose material can be unloaded at from 2.5 to 3 ton per hr with man hours approximating one per ton. Palletized material can be unloaded at from 20 to 30 ton per hr and about 15 ton per man hour.

Estimates of the percentage of material now palletized, made by various carriers and shippers, some on one basis some on another, range from 10 to 52 per cent, the average running from 25 to 30. Probably the most conclusive data is in Table I. Approximately 40 per cent of the trucks in and out of the plants carried pallets. A short check at the Ford plant indicated 30 per cent. The importance of truck shipments in the auto industry is indicated by the fact that since January 1947 Ford Motor has spent $1,200,000 for loading docks and has $470,000 more planned.

Pallet Costs

Pallet cost estimates ranged from a low of $0.50 for expendable type to $51 for metal pallets and collapsible containers. Ford company uses both wood and metal types and its inventory of 262,000 pieces is valued at $2,000,000 an average of $7.65 each.

The importance of freight as compared to pallet cost is indicated by the freight costs on the first General Motors case shown by the top photographs. The pallets on this shipment weighed 190 lb each or close to the average. The four loads on which data are available cover 49 pallets ranging from a low of 70 lb to a high of 333 but averaging 168 lb.

On the first pallet shipment, 20,150 lb gross and 19,200 lb net, the freight rate was 13 ct per cwt. On the returned pallets the rate was 65 ct. Freight on the castings was $24.96, and on the five pallets both ways, $7.42. The new rate would cut the total pallet freight cost 40 per cent or $3.08.

Reduction in loss and damage claims was put forth as a matter of considerable value to carriers. Ford Motor submitted records covering 141 claims filed against 31 carriers. Only one of these 141 claims was against a palletized load.

It was conceded that pallets necessitate reinforced trailer floors and side protection. This, however, appears to be advisable for all common carriers handling industrial freight whether or not pallets are involved. At least it is standard practice for those testifying. Some lines order trailers so equipped, others do it themselves.

One company reinforces the floor with a steel plate at a cost of $22.00 per trailer and with a weight increase of 182 lb. Another uses rough cut oak or elm for the double floor. Two men lay the floor in half a day and 1000 ft of lumber takes care of four bottoms. The cost was placed at $47.00 per trailer for material. Side wall protection is given by steel plates salvaged from old trailers.

The highest estimate given was $88.00 for the double floor and $167 for sheet steel side protection 42 in. high. It was indicated that this total cost of $255 can be cut in half if done at the time the trailer is built.

Table I. Average detention time chargeable to shipper and carrier on 1418 trucks, loaded and unloaded, at eight General Motors plants during one week

LOOSE	Vehicles No.	Shipper Hr	Shipper Min	Carrier Hr	Carrier Min
In	430	13	19	4	8
Out	354	6	26	1	15
PALLETIZED					
	Vehicles No.	Shipper Hr	Shipper Min	Carrier Hr	Carrier Min
In	368	4	32	1	32
Out	266	3	47	1	18

One of the newest developments mentioned was Trailmobile's offering of $\frac{5}{16}$ in. aluminum floor for $200 extra. The floor saves 1000 lb in trailer weight and is guaranteed for the life of the trailer. Through fair wear and tear it has been estimated that an average trailer needs refloorıng every 3 yr at a cost of $250. The lifetime guarantee is significant.

Opposition to the proposed lower rates stemmed largely from two associations of motor carriers, Motor Carriers Central Freight Assn. and the Michigan Intra-State Motor Freight Bureau, Inc. Apparently the main concern was: whether the proposed rates would be compensatory; whether the advantages claimed would in fact materialize; and if so, whether they would be offset by other factors.

Specifically a number of objections were raised. Pallets require additional carrier capital investment due to need for heavier equipment, double floors, supports and side wall protection. The increased weight reduces the pay load or means increased power to pull the trailer. Additional investment is necessary for dock and terminal facilities. Difficulties in definition and control involve danger to the carriers of further extension to all types of containers, drums and cartons.

On the question of rates, they contended that: Palletized shipments have already been favored in two ways, a reduction of 5 ct per cwt on freight, and reclassification of empty pallets to fourth class; and, the shipper had more to gain from a reduction in rates on the live load than on the empty pallets.

Current Rates above Floor

The latter would require no action by the Commission because current rates are materially above the Michigan minimum rate schedule. The Commission also pointed out that even the current empty pallet rate might be considerably reduced within the present rate structure, in a specific case from 48 to 32 ct per cwt. The proposed rate in this case would be 24 ct per cwt. All truck lines, the opposition hammered on continuously, took advantage of a recent 10 per cent increase in rates across the board. They can, within their own authority, make drastic reductions on individual classifications without action by the Commission.

Space does not permit detailed reply to these objections. Exhibits, data and expert, experienced opinion from both shippers and carriers demonstrated, however, that the objections were minor or non-existent and that palletization would permit carrying the same pay load with less equipment.

The hearing and subsequent decision at the Michigan Commission, is momentous from the standpoint of palletization. Michigan, because of the minimum rate order and Commission policies, is somewhat of a bellwether. A favorable decision will be important in influencing other sections of the country.

An adverse decision will be serious but not fatal for palletization means too much to industry in general to be held to its present level. In this case two alternatives remain. First, carriers can charge an increased rate, say 2 ct per cwt, on palletized shipments to cover the return of the pallets without further charge. Second, industry can operate its own trucking service.

Both methods are already in limited use. Major elements of both sides hope that the Michigan P.S.C. decision will act favorably on the petition and permit increased palletization on a rational freight rate basis. Industry prefers to allocate charges as they are incurred and is adverse to engaging in common carrier activities alien to its business. Common carriers do not relish deferred responsibilities nor shrinkage in volume by private competition.

The Commission decision will be announced as available, probably in the February issue.

What's On at the Show?

There will be a lot of surprises at the 3rd Materials Handling Exposition . . . Old line manufacturers are introducing radically different products . . . Advances in electronic control, maintenance equipment, truck attachments, hoists, cranes will make the plant engineer's job with materials handling a lot happier one but in some ways more complex, too . . . As pointed out elsewhere in this issue: Stay on top of your job, not under it, and this new equipment and knowledge of its availability is a must. Only companies reporting in time are included

COMPANY AND PRODUCTS — **BOOTH NO.**

Acme Pallet Co. — 22—23

Wood, Shipping and Aluminum Pallets.

Addison-Semmes Corp. — 611

Expendable Pallet and photographic display of its use.

Albion Industries, Inc. — 101

Industrial Casters and Wheels and working display unit.

The Alvey-Ferguson Co. — 142

Traffic Control Device, Portable Belt Conveyor, Roller, Wheel Conveyors and Chain and Trolleys. Miniature belt and live roller conveyor in operation handling packages.

Baker Industrial Truck Div. — 608-B—609

Five models of Fork Trucks, a Low-Lift Truck and a Crane.

Barber-Greene Co. — 820—831 832 and 833

Full-size Permanent Conveyor and Conveyor Components, Two Models of Portable Belt Conveyors. Photo murals and Kodachromes of equipment in action.

Benbow Mfg. Co. — 17

Table display showing section of Monorail with Benbow Safety conductors attached thereto with current collectors showing method of energizing cranes, hoists, tools.

Bond Fdry. and Machine Co. — 147

Industrial Truck Casters and Wheels, Hand Trucks, Lift Jacks and Platforms, Other Material Handling Equipment.

Buschman Co., The E. W. — 509

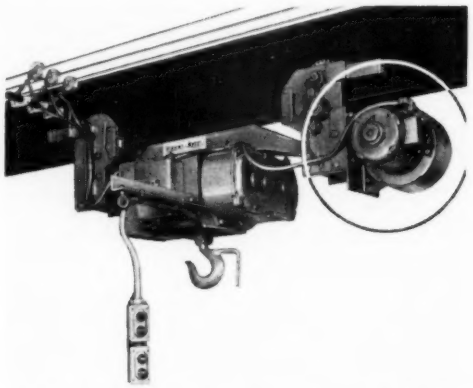
Reports: "Will have an unusual display but would not care to reveal nature at this date." Reveals: "Will show overhead trolley conveyor, belt and gravity conveyor."

Chisholm-Moore Hoist Corp. — 826—827

Aluminum Hand Chain Hoist suspended on scale to show weight of 35 lb for 1 ton model; Heavy Duty Electric Hoists with glass cover to show inner works; Electric chain hoists, light weight plug-in types showing operating characteristics through glass cover; Aluminum alloy Puller, a utility tool for use in lifting, pulling or dragging loads at any angle; other products.

C.I.T. Corp. — 834—835

Information and On-the-Spot Service in connection with financing of materials handling equipment.



This new self-propelled hoist, fluid drive, will be introduced by Robbins & Myers, Inc., at the Exposition. The company states that the unit is entirely practical from the standpoint of economy and performance and promises many benefits to all phases of materials handling

Clark Equipment Co. — 526—527 602 and 603

Nine basic machines, eight of them fork lift trucks, will constitute the major portion of the exhibit; Six special attachments also will be exhibited.

Coffing Hoist Co. — 54

Safety Pull Ratchet Lever Hoist, Electric Hoist, Spur-Geared Chain Hoist, Hoist Jack, Puller, Safety Load Binders, I-Beam Trolleys.

Coles Cranes Inc. — 409

This new American Branch of an English firm will exhibit the smallest crane in its line, the Model 8506 and a medium sized one, Model 8502. They are mobile units and are available in several models from 1 to 6 tons.

Colson Equipment & Supply Co. — 313

Dumpers which, at the turn of a control switch, will lift and pour any free-flowing material.

Economy Engineering Co. — 312

Featured will be the company's Hi-Reach Platform Telescopers for overhead maintenance work. One of these models will be the 15 ft standard PUL, hand operated unit and the second will be a Box Frame unit, electrically operated, with a 30 ft platform elevation. Two of the "Shop Lifters," a hand operated and an electrically operated unit, will be shown, also.

(Text continued on page 62)

Jeffrey

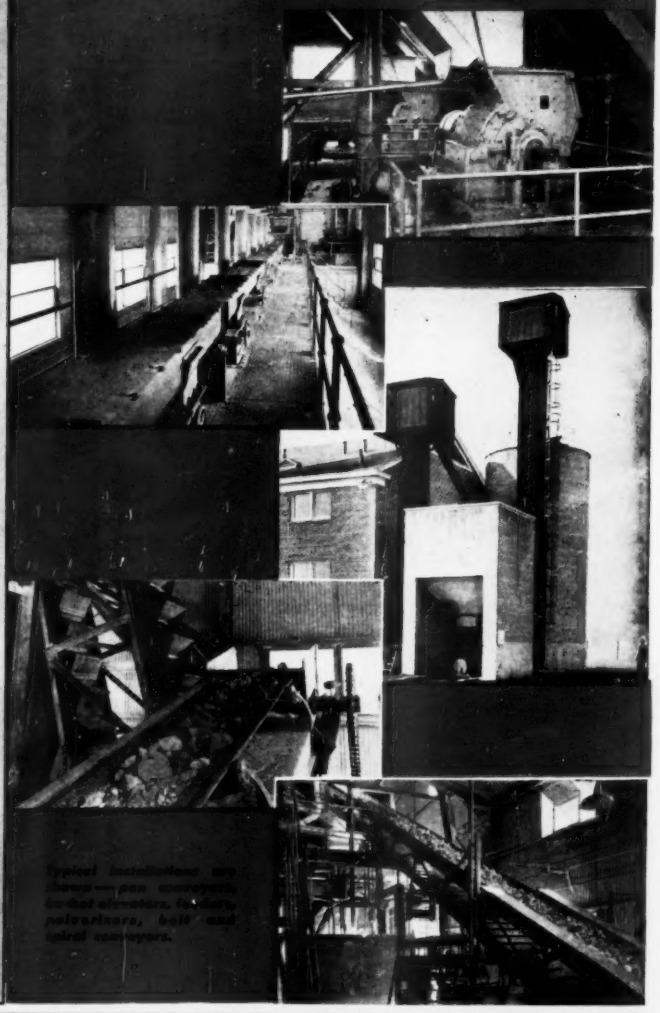
. . . your source of cost reduction information

For years, Jeffrey has accumulated knowledge by doing . . . knowledge which can be applied to improve material handling and processing methods in YOUR plant.

From sugar beets to steel ingots . . . from coal mines to soup canneries . . . it little matters what branch of industry you select, Jeffrey has probably developed and installed material handling and processing equipment to serve it.

Steel plants, mines, food processing and packing plants, automotive, radio and metal working plants, foundries, glass and ceramic plants, quarries, sewage treatment and water purification plants, power plants and engineering projects . . . the list runs on and on through industry, commerce and public service.

This rich experience is at your disposal . . . call upon us.

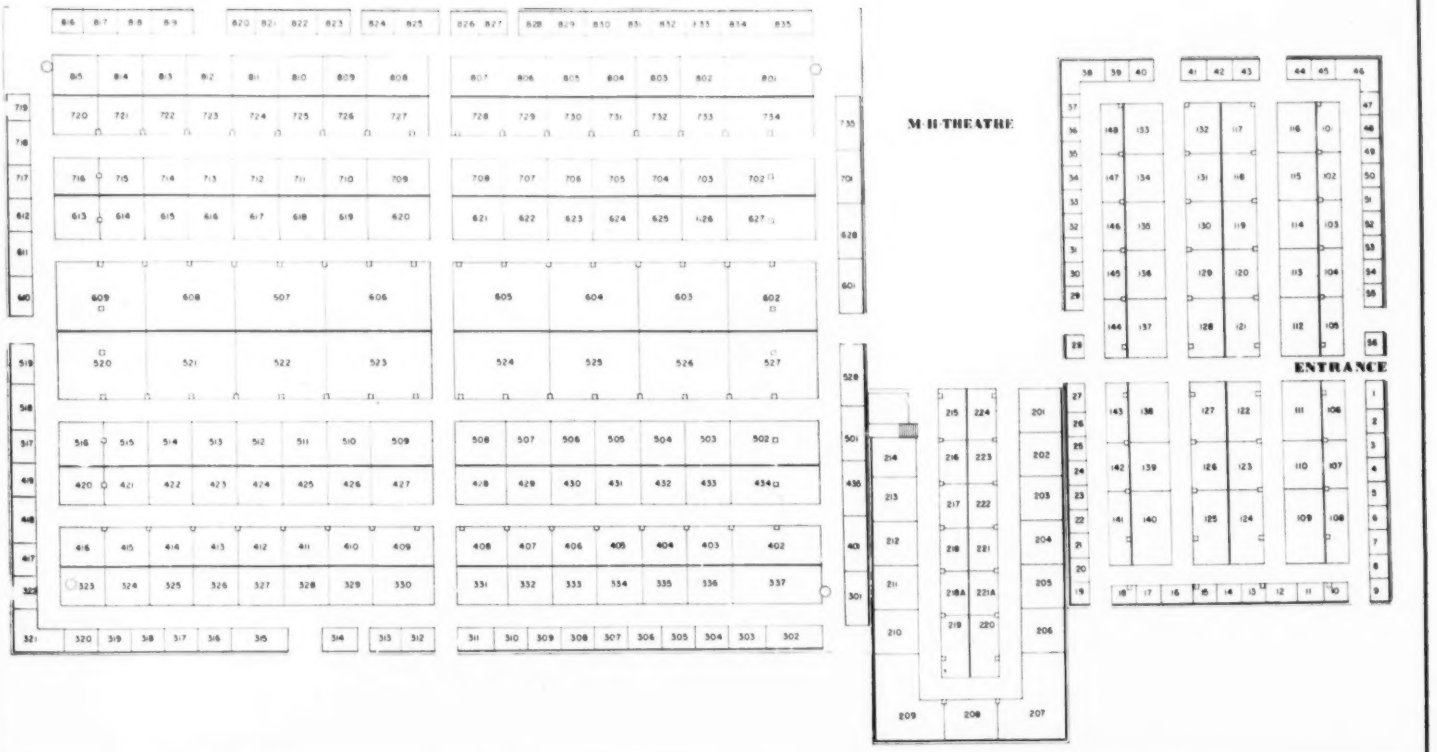


THE JEFFREY MANUFACTURING COMPANY
ESTABLISHED 1877
Columbus 16, Ohio

Complete Line of Material Handling, Processing and Mining Equipment

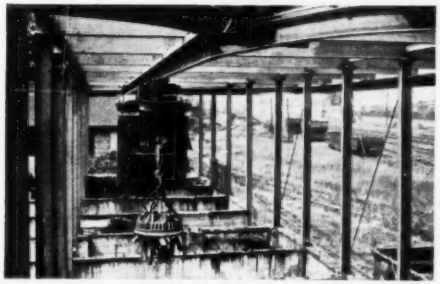
3rd NATIONAL MATERIALS HANDLING EXPOSITION

Held at Convention Hall, Philadelphia



MOVE HEAVY LOADS ON MONORAIL

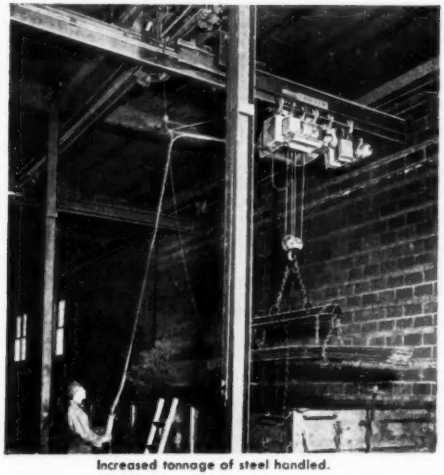
FOR LOWER COST HANDLING



Saves $25.00 per car unloading pig.

Saves 32c per ton handling rod.

Delivers metal with 60% less labor.



Increased tonnage of steel handled.

Tough jobs to handle are naturals for Mono-Rail. Any American MonoRail system increases plant capacity and production pace, conserves skilled labor, reduces damage and accidents and SAVES YOU MONEY.

Any system, regardless of how complicated, will pay for itself in time and money saved. One company reports a savings of 86% in handling costs.

Whatever your handling problem may be, there is an American MonoRail system adaptable to it. From the simplest hand-operated unit to the most complicated fully automatic system, American MonoRail engineers can suggest a system best suited to your problem.

SEND FOR BULLETIN C-1. A 56-page book showing successful applications of American Mono-Rail Systems.

THE AMERICAN MONORAIL COMPANY

13123 ATHENS AVENUE CLEVELAND 7, OHIO

The Electric Products Co. **614**

New and improved motor-generator battery chargers for both motorized hand-lift trucks and ride-on trucks. Included will be completely redesigned single-circuit charger for motorized hand-lift trucks.

Elizabeth Iron Works, Inc. ..... **828—829**

One-man bridge ramp, all-steel, 15,000 lb capacity which is used with a fork truck; Two new ramps: Refrigerator Car Ramp, 15,000 lb capacity steel ramp to fit refrigerator car doors and Master Medium Hand Truck Ramp, 4,000 lb capacity steel ramp for use with hand trucks. Also pallets and other ramps.

Elwell-Parker Electric Co. ..... **615—616 and 713—714**

Nine trucks: Crane Truck, capacity, 3000 lb, 7-ft radius; Low Lift Platform Truck, capacity 6000 lb; Telescoping High Lift Platform Truck, capacity 6000 lb; High Lift Platform Truck with die puller attachment, capacity 10,000 lb; Hydraulically Operated Fork Truck equipped with bale clamp, capacity 2000 lb; Center Control Fork Truck equipped with pallet retriever, capacity 3000 lb; New End Control Fork Truck equipped with Roll Paper Clamp which is hydraulically operated, capacity 3500 lb; Telescoping Fork Truck equipped with scoop, truck capacity 400 lb, scoop capacity 12 cu ft; Telescoping Fork Truck, capacity 6000 lb.

Euclid Crane & Hoist Co., The **732**

Five-ton Standard Electric Overhead Crane Trolley. Trolley has 12 in. drum and a lift of 40 ft at a speed of 40 fpm. Powered by 15 hp at 1200 rpm hoist motor and a 2 hp at 1200 rpm trolley motor. Operating miniature will be on display.

Fairbanks Co., The **105**

Variety of types of Steel-Framed Hand and Platform Trucks; Included is new Minneapolis Style Two-Wheel Bag Truck. Also light, medium and heavy duty Casters; representative sizes bronze and iron body Valves.

Federal Telephone & Radio Corp. **712**

Line of Selenium Rectifier Industrial Truck Battery Chargers will be displayed. This line will include a newly introduced type for charging large-size, driver-led trucks.

Garlock Packing Co. **834**

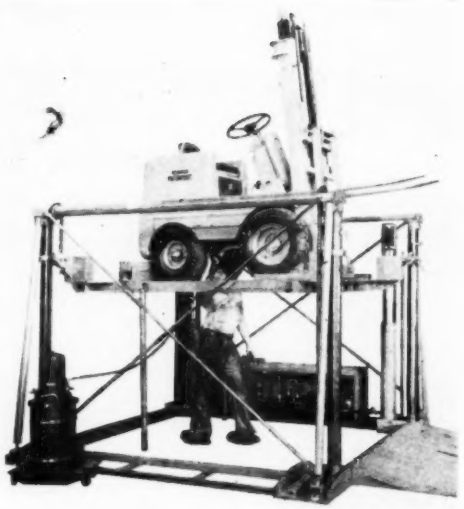
Mechanical packings and specialties of interest to builders of materials handling equipment. Special emphasis will be placed on sealing units for hydraulic application.

General Electric Co. ..... **733—734**

Displayed will be a 25-t Diesel-Electric Locomotive, a new ACA Gear Motor, a Totally Enclosed, Textolite Fan-Cooled Motor; a Rectifier Battery Charger with a Sequence Charger mounted on it; a Motor-Generator Battery Charging Set; Control Equipment for 4-Circuit Battery Charger System; a Battery Truck Motor; Control Panel and Master Switch; Photoelectric Counter; Pendant Crane Control and Tri-Clad Gear Motor.

Gould Storage Battery Co., The **728**

Scale model fork truck, maneuverable by show visitors through standard full-size truck controls. Giant electronic recorder will indicate each stop and go (and the strains involved) in simulating any materials handling sequence the visitor chooses to imitate. Also shown will be the new State-of-Charge Indicator which gives truck operators a constant visual check on battery condition. Battery construction will be displayed, too.



This is the newly developed electric hydraulic lifter for servicing all makes of industrial trucks and trailers. It is being exhibited at the show by Service Caster & Truck Corp.

J. W. Greer Co. **315**

Scale model of the company's Multi-Tier, a continuous processing conveyor system which is said to frequently eliminate all manual handling, occupy little floor space, provide constant control, and to be extremely versatile.

Hydraulic Equipment Co. **731**

Operating display of a typical industrial hydraulic control system. By means of full size plastic models of hydraulic systems similar to those in use on many lift trucks will be illustrated. A photo montage of many types of materials handling equipment will form exhibit background.

Hyster Company ..... **428—429—430 506—507—508**

Display will be of the demonstrating type with Standard Lift Trucks and the Karry Krane. A new model Straddle Truck and several new attachments for the recently-developed Load-Grab Attachment will also be exhibited.

Industrial Tire & Wheel Co. **45**

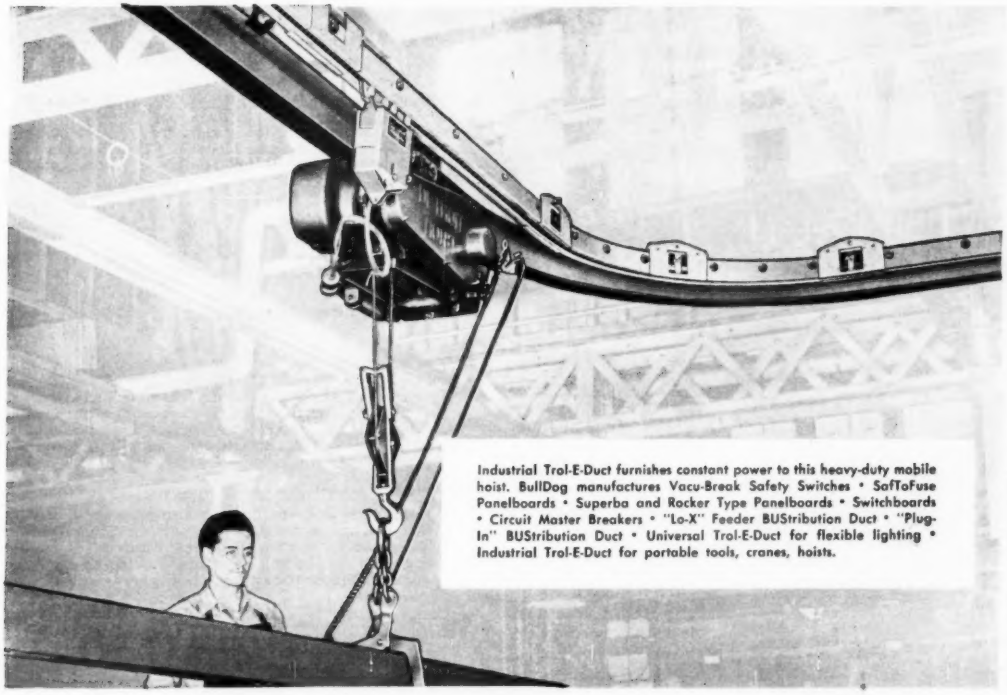
Company will exhibit its Tuf-Tread rubber tired wheels, solid rubber tires, Tuf-Tread Quality Casters. The latter is an entirely new item; the others are improved.

Island Equipment Corp. **207**

Display will consist of working installation of several types of conveyors. Included are Horizontal and Incline Belt Conveyors, Chain Conveyors, Conveyor Tables, Portable Belt Conveyor Booster and Cleated Belt Booster.

Keen Manufacturing Corp. **104**

New Type of Two-Wheel Industrial Floor Truck described as five trucks in one, change made by pushing down on the foot pedal and changing the angle. Also 14 other types of industrial trucks will be shown.



Industrial Trol-E-Duct furnishes constant power to this heavy-duty mobile hoist. BullDog manufactures Vacu-Break Safety Switches • SafToFuse Panelboards • Superba and Rocker Type Panelboards • Switchboards • Circuit Master Breakers • "Lo-X" Feeder BUStribution Duct • "Plug-In" BUStribution Duct • Universal Trol-E-Duct for flexible lighting • Industrial Trol-E-Duct for portable tools, cranes, hoists.

Perfect power partner for mobile electrical loads

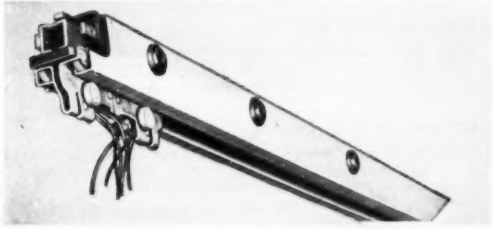
WHEN power takes a trolley ride to stay near the portable tool or other moving equipment it supplies—that's good news for production!

BullDog Industrial Trol-E-Duct provides a power source for moving electrical loads, does away with lengthy extension cords and dangerous open trolley wires.

Industrial Trol-E-Duct is designed for such electrical "loads" as crane and hoist runs, or portable tools. Every inch of the continuous slot that runs the length of the duct is an electrical outlet. Tap-off trolleys roll smoothly alongside cranes, hoists and tools, feeding power as they move along with the job.

Duct is made in ten foot sections, both straight and curved, to fit any floor plan. It is sturdily constructed of Lustro-galvanized steel sheathing enclosing the copper bus bars. Industrial Trol-E-Duct is 100% salvable, can be relocated time and again to meet any change in your plant. Capacity: 90 Amps., 575 Volts or less.

Call in a BullDog Field Engineer for further information on this remarkable power distribution system. If you like, he can easily arrange to show you a similar installation in your own neighborhood.



Close-up view of section of Trol-E-Duct, showing how tap-off trolley rides in slot. Trolleys are fed electrically and supported mechanically by Industrial Trol-E-Duct.

BullDog's Field Engineers welcome the opportunity to sit in with you during the early planning stages of a building project. Their knowledge of electrical distribution layout can mean savings in installation costs, as well as efficiency and reliability in actual operation. Why not take advantage of this service?

BULLDOG ELECTRIC PRODUCTS COMPANY

DETROIT 32, MICHIGAN • FIELD OFFICES IN ALL PRINCIPAL CITIES

IN CANADA: BULLDOG ELECTRIC PRODUCTS OF CANADA, LTD., TORONTO

BULLDOG

HEADQUARTERS FOR ELECTRICAL DISTRIBUTION

SAFETY
in factory maintenance work with a Model PUL TELESCOPER

Overhead crane maintenance 22 feet above the floor, as illustrated, used to be a hazardous undertaking.

Now one man sends the platform of this Hi-Reach Telescoper to its maximum height of 15 feet, putting whatever tools he may need on the platform beforehand. He then walks up the steps to the first landing and climbs the ladder to reach the roomy platform where he is then able to work with full security.

Model PUL when telescoped down to its minimum height is only 6'8" high and 32" wide, allowing the machine to be taken through an ordinary doorway and onto freight elevators for transport to any part of the plant. Model PUL is equipped with basewheels and is fully portable.

THREE STANDARD MODELS

No. 1 Platform lift, 10 ft. 9 in.	$280.00
No. 2 Platform lift, 11 ft. 9 in.	290.00
No. 3 Platform lift, 15 ft. 0 in.	315.00

f.o.b. Chicago, freight allowed.

SEE Hi-Reach Telescopers at Booth 312
MATERIALS HANDLING EXPOSITION

Write for full details of Model PUL and larger Telescopers.

ECONOMY ENGINEERING COMPANY

4522 W. Lake Street • Chicago 24, Illinois

Lansing Industrial Sales Co. **21**

Display of complete Wheel Line for materials handling equipment. Sizes range from 4 by 1½ to 20 by 5 in.

R. G. LeTourneau, Inc. ..... **809—810—811—812**

Company's participation in show will serve to demonstrate the Tournacrane, Model EC-7; to introduce an entirely new line of full-revolving, off-road mobile crane.

G. B. Lewis Co. **701**

Line of Industrial Containers including box trucks, stacking boxes and stacking skid boxes.

Lewis-Shepard Products, Inc. ..... **623—626—627 702—703**

In addition to the line of Power Fork Trucks, Electric Lift Trucks, Electric Tiering Machines, Hydraulic and Mechanical Hand Lift Trucks, Portable Elevators, the exhibit will feature the Telescopic Electric Tiering Truck, Riding Type Electric Jacklift Truck and others. A wide line of special attachments will be featured.

Lyon-Raymond Corp. ..... **710—711**

Plans being made to have a punch press on display so that practical application of Hydraulic Sheet Feeding Table can be emphasized. Also, improved Hydraulic High Lift Trucks will be shown for first time. Other products will be presented, too.

Magline, Inc. **10**

Display will consist of complete line of Magnesium Hand Trucks, Magnesium Dockboards, Magnesium Carloading Tubes and Magnesium Can Forks.

May Fran Engineering Co., Inc. **628**

Will display large photographs and transparencies of special equipment with working models of Sheet Lifter, Little Hustler Conveyor and Hinged Type Steel Belt Conveyor. Latter is a new item.

Mercury Manufacturing Co. ..... **324—325**

Company will exhibit three new trucks: one of them is a new Roto Lift Truck; the second is a small hand truck and the third is a small electric truck for use in crowded areas because of its unusual maneuverability.

Motor Generator Corp. **823**

Exhibit will be confined to display of company's MGC Automatic Battery Chargers. Particular models to be displayed not decided on at press time.

Monroe Auto Equipment Co. ..... **304—305**

Feature of display will be Lightweight, All-Steel Pallet and Drop-Bottom Skid Box. Pallet is manufactured in two weights and one size.

National Metal Edge Box Co. **718**

Metal Edge Stayer will be shown in actual operation; also display of Metal Edge Boxes being produced for various manufacturers.

Orangeville Mfg. Co. **622**

All-Metal Trucks for handling such items as beverages, barrels, tombstones, etc. Trucks will be our regular line of two- and four-wheel models.

Otis Elevator Co. **431**

Pow-R-Truck Elevators, designed to take heavy industrial truck punishment and first announced in 1947.

"Hands off" handling...

with Buschman

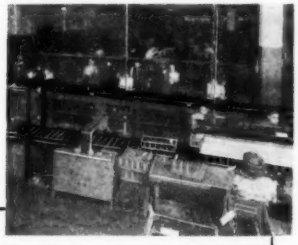
"ENGINEERED" CONVEYORS

You can make your entire production system a "no hands" affair with Buschman Conveyors.

Efficient Handling Reduces Costs. Whatever your needs, for receiving, manufacturing, assembly and shipping, there's a Buschman Conveyor to do the job.

For that "tough" conveyor problem, let Buschman Engineers take over. They'll show you — at no obligation — how Buschman low-cost Conveyors fill your needs.

For complete details write for Catalog No. 300.



Designed for the job, Buschman "engineered" Conveyors are planned and built to meet your special needs.

Buschman *Conveyors*

The E. W. Buschman Co., Inc.
4426 Clifton Ave.
Cincinnati 32, Ohio

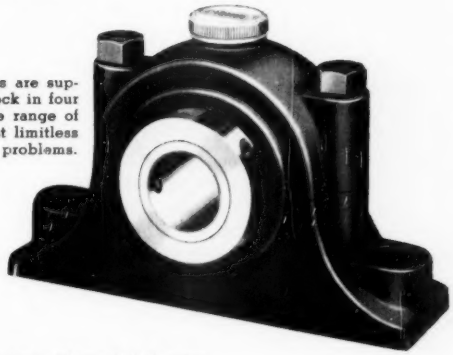
See 'em at the Show

TWO GREAT NAMES... DODGE-TIMKEN!

It was Dodge who took the famous Timken Bearing, mounted it, sealed it, housed it and delivered a pillow block of new high quality — fully assembled, ready to lock on the shaft and carry the power loads of industry with new efficiency.

Dodge develops *outstanding* power transmission products, as proved by the big success of Dodge-Timken Bearings on millions of industry's toughest jobs.

Dodge-Timken Bearings are supplied promptly from stock in four basic types and a wide range of sizes to meet an almost limitless variety of anti-friction problems.



Dodge also produces Ball Bearing Pillow Blocks which, with Dodge-Timken Bearings, comprise the famous "30,000 hour line." Write for complete bulletins.

DODGE MANUFACTURING CORPORATION
Mishawaka, Indiana

DODGE

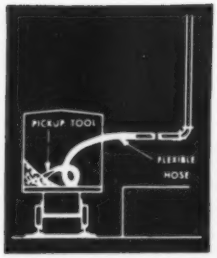
of Mishawaka, Ind.

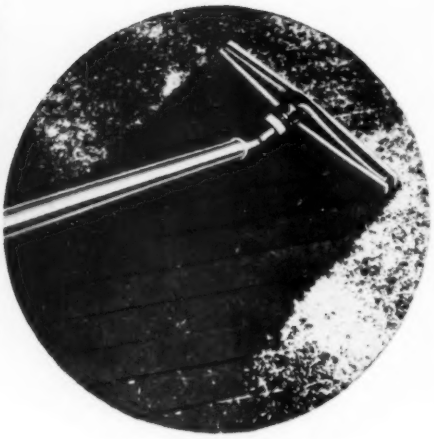
CALL THE TRANSMISSIONEER

He is your local Dodge Distributor — factory trained — qualified to suggest ways to improve your machine performance, increase production. Look for his name under "Power Transmission Equipment" in your classified phone book.

Copyright, 1948, Dodge Mfg. Corp.

NAME PLATES FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS





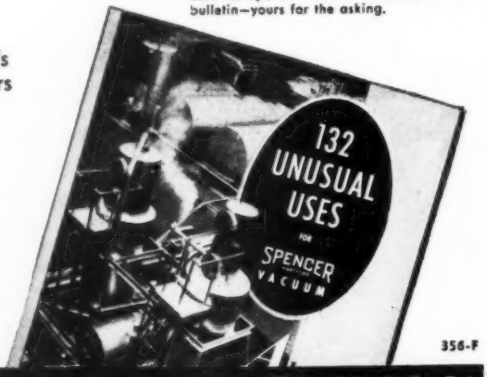
CONVEYING OUNCES OR TONS WITH SPENCER VACUUM

Pneumatic conveying is an economical and dustless method of moving bulk material by the tons. Used for unloading freight cars or boats, transferring material from one part of the plant to another or in many other ways. Usually the equipment is permanently installed with automatic dumps on the separator for discharging the material into storage bins or hoppers. Portable machines capable of handling up to 4 tons per hour also available and can be moved up to the side of a gondola freight car for disposal of the material collected. Any type of free flowing materials can be handled.

The following are only a few of the different kinds of material handled by Spencer pneumatic conveying systems:

Ammonious Beryllium Fluoride
Ashes
Bauxite
Bone Ash
Breakfast Cereals
Chemical Powders
Cinders
Dried Beans
Food Products
Lamp Black
Lead Dust
Metal Chips
Oils
Rice
Sand
Silica Sand

Conveying is only one of the 132 unusual uses for Spencer Vacuum described in this bulletin—yours for the asking.



356-F

SPENCER VACUUM CLEANING
HARTFORD
THE SPENCER TURBINE COMPANY, HARTFORD 6, CONN.

will be featured. Other products will include general purpose freight elevators.

Pittsburgh Steel Products Co. 511

The Cargotainer, palletized wire basket with collapsible sides and ends, used for storing, shipping and handling materials, and an 8-way steel wire pallet which forms the base of the Cargotainer, will be shown separately. Also, Seamless Steel Tube and Wire Mesh Bulkhead.

Robbins & Myers, Inc. 133

Achievement in advanced overhead handling will be introduced. The adaptation of fluid drive to High-Speed Self-Propelled Hoists in the exhibited model is achieved by the use of a double-action hydraulic coupling connecting the motor and a simple gear train. The combination produces a sustained flow of power and produces an unusual smoothness of operation. Manufacturer states that full torque of motor is evenly applied at all output speeds. Also shown will be an operating cutaway version of standard 2-t. capacity. Hoist which will afford visitors view of working interior.

Ross Carrier Co., The ..... 617—618—619

Accent at Show will be on Pneumatic Tired Lift Trucks and the Straddle Truck. Manufacturer not decided, at press time, what models will be displayed, but will probably show several.

Rowe Methods, Inc. 404

A complete line of Hydraulic Equipment, designed to maintain horizontal alignment between a shipping and receiving dock and the trucks or trailers being worked, will be exhibited. Methods of adjusting either height of truck to dock or height of dock to truck will be part of display. Models will be in operation.

Saginaw Products Corp. 146

Complete line of industrial pneumatic casters, pneumatic wheels, factory wheels and casters of the pressed steel type and conveyor parts which consist of trolley wheels, special brackets, chain hoist trolleys, roller turns, etc.

Service Caster & Truck Corp. 520

First showing of the new Service Maintenance Lift for industrial trucks. Designed as a better, safer way to care for industrial trucks, the Lift is built in 6000 and 12,000 lb capacities and includes many safety features. Other products shown will be: complete line of casters, floor trucks and trailers.

Signode Steel Strapping Co. 708

Several types of strapping machines will be on display and will be demonstrated.

Speedways Conveyors, Inc. 201

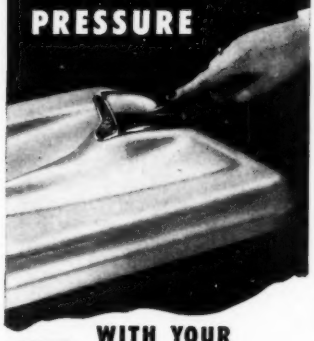
Running exhibit of Speedcase conveyor which will travel continuously, interrupting an electric eye counter on each revolution, will be featured. Five lucky guessers on the number of revolutions made during show will receive prizes. Endless belt conveyors and other equipment also shown.

Steel Parts Mfg. Co. 120

Exhibit will consist of three con-

EASY

FINGER-TIP PRESSURE



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All models meet the requirements of the National Bureau of Standards, U.S. Dept. of Commerce. Approved by Underwriters' Laboratories, Inc.

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NO OTHER STRAINER

OFFERS ALL THESE ADVANTAGES

A good strainer protects your equipment and pipelines. Yarway gives you a better strainer to "police your pipelines".

- FIRST—*The Screen* is a high-grade woven monel wire basket that catches solids, lets condensate, oil or other fluids flow freely. Perforated screens if desired.
- SECOND—*Screen cap* is made with straight thread, machined face and spark-plug-type gasket, insuring tight joint. Screen comes out with cap for easy cleaning . . . automatically aligns when replaced.
- THIRD—*Iron and steel bodies* are *cadmium-plated* for protection against corrosion and for better appearance.
- FOURTH—Available in six sizes, from ½" to 2" for pressures to 600 lbs.
- FIFTH—Reasonably priced.
- SIXTH—Stocked and sold by 150 Mill Supply Houses. Hundreds of thousands already in use. See your local dealer or write for Bulletin S-201.

YARNALL-WARING COMPANY

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YARWAY STRAINERS

"Police the Pipelines"

...with DARTS you get a Union that's

DROP-TIGHT

ECONOMICAL

STURDILY BUILT

EASILY INSTALLED

Their two bronze seats, ground to a true ball joint, mean longer service

Dart Unions are different. Their tightness is not derived from an ordinary "jammed" joint, but from two bronze seats ground to a ***true ball joint***. They close drop-tight without excessive wrench pressure and open just as easily. What's more, they can be used over and over again in different locations. Both the body and nut are made of high-test, air refined malleable iron and are practically indestructible.

Let your supplier show you Dart's unique construction.

E. M. DART MFG. CO.
Providence 5, Rhode Island

DART UNIONS

veyors. One of them will be a vertical unit, another a horizontal; both of these will be permanent installed types. Will also have an adjustable, press-to-press unit for heavy work, on display.

Steel Strapping Div., Stanley Works ... 12

Ace Strapping Tool with Automatic Seal Feed will be featured. Also on display will be All Reel Stand with a new brake feature.

Sterling Bolt Co. ... 406

Complete line of bolts, nuts, pins and other fasteners used in materials handling equipment.

Thermoid Company ... 528

On an attractive animated background miniature conveyor and transmission belts will be in motion with the background lending realism to their operation. Samples of the company's products will also be displayed.

Triangle Equipment Co., Inc. ... 7—8—9

Shown will be the Tipp Cable-Way Conveyor, the Tipp Toter, the Tipp Wheel Rail Conveyor and the Tipp Freight-Ladder. The Toter and Freight-Ladder are new.

Unit Manufacturing Co. ... 3

Certain models of the company's line of Aluminum Life-Time Hand Trucks; several of the larger sizes of these trucks will be shown for the first time.

Wellington Machine Co. ... 50

Heavy duty, easy rolling, Rubber Tired Wheels and Casters and other truck and trailer gear will be on display.

Westinghouse Electric Corp. ... 110—111

Exhibit will feature gearing products, Life-Line Motors, Beaver control including Life-Line Starters, battery-charging motor generator sets, new reactor controlled rectox chargers and improved magnetic control for electric trucks. The Oomph-meter will also be there.

Wilkie Co. ... 332

The company's telescopic, portable conveyor will be displayed at the show in order to demonstrate the ease with which it can be put into box cars, trucks and similar tight places.

Wood Pallet Co., Inc. ... 31

The company's new Take-It-Or-Leave-It Pallet will be exhibited for the first time. This pallet permits the loading of the pallet for storage, palletizing the material and removal of the load without the pallet thus eliminating re-handling. Also shown will be an expendable pallet and others.

Yale & Towne Mfg. Co., The ... 521—522—523

An electronic hoist, designed for such applications as transporting goods over-the-water from warehouse to ship and carrying products across large manufacturing plants, permits several hoists to be electronically controlled; New line of Gasoline Operated Trucks; New line of Scales

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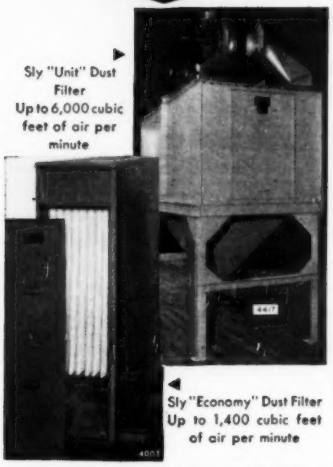

Sly "Unit" Dust Filter
Up to 6,000 cubic feet of air per minute

Sly "Economy" Dust Filter
Up to 1,400 cubic feet of air per minute

USED FOR DUST EXHAUST FROM INDIVIDUAL MACHINES OR GROUPS OF SMALL MACHINES

Hundreds of these Sly Dust Filters collect all the dust from grinding, screening, mining, packaging, and finishing operations. Greater filter cloth area assures greater collecting efficiency and longer life.

For special purposes, these filters can be built of stainless steel, galvanized iron, aluminum or nickel.

Sly Dust Filters are also available with unlimited capacity for larger installations.

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ASK FOR BULLETIN 98.

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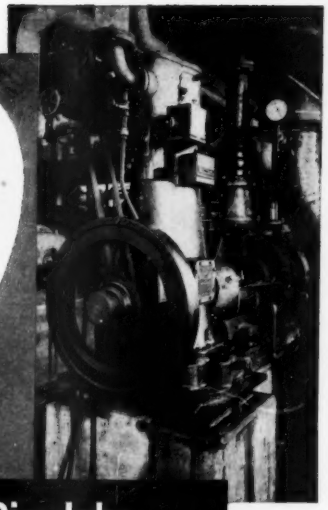

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With proper plant heat balance your steam may do two big jobs. If you generate steam for processing or heating a Troy-Engberg Steam Engine can produce By-Product Power at a very low cost. The same steam then yields power as well as heat units!

It's the simplest story in the plant. Steam is first passed through the engine — driving pumps, stokers, compressors, blowers or generators. Then the exhaust, with most of the original heat units still intact, is used for processing or heating. And for dependability nothing beats the standard counterflow steam engine . . . no interruptions from power failure.

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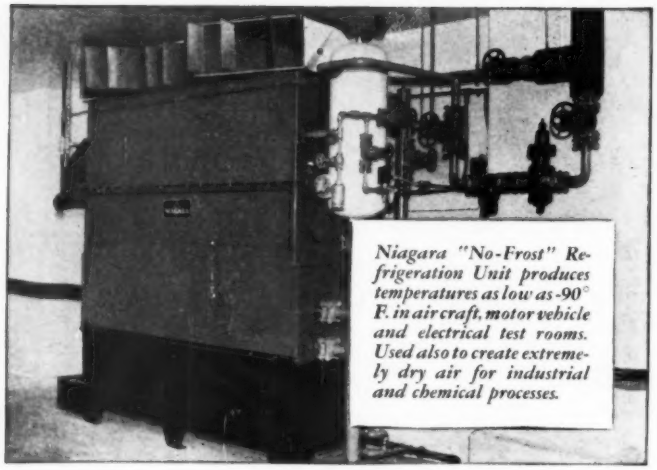

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This Company has worked for many years among such problems and has developed special apparatus that has helped many industrial leaders to improve their manufacturing.

Always, there is a problem of moisture and temperature, whether it may be a special gas atmosphere for heat treating, or air under most precise specifications for a process with hygroscopic materials, or a "cold test" room at -90° F.

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INDUSTRIAL COOLING HEATING • DRYING

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HUMIDIFYING • AIR ENGINEERING EQUIPMENT

Bulletins . . . . Catalogs

(Continued from page 28)

been added and these are discussed in the booklet by means of engineering drawings and photomicrographs. The booklet will be of considerable assistance to those who purchase or specify roller chains. Atlas Chain and Manufacturing Company.

TOOLS

131 Tools Manual—There are 106 pages in this recently issued Catalog S. Described in the catalog are all types of tools and accessory equipment such as steel tool cabinets, mechanics kits, mechanics chests, socket wrenches, sockets, offset box socket wrenches, open end wrenches, screw drivers, punches, chisels, pliers, hack saws, hammers, and many others. The book is a veritable guide to tooling practice in the small hand tool and electric tool line. There are few, if any, tools which are not represented in this book. It is exceptionally well illustrated and the index makes for easy reference. Snap-On Tools Corporation.

132 "The Muscle Misers" — Under this title a new 32 page pocket-size booklet on pipe tools has been announced. The booklet is in short-story form, cartoon illustrated, to show interesting incidents in the experiences of the "muscle misers." Each story deals with the different type of seller and user of the company's power vise stand, a portable unit designed to motorize hand pipe tools such as die-stocks, pipe cutters and reamers. Several pages in the booklet include photographs and descriptions of a power vise stand and three other portable threading machines. The Oster Manufacturing Company.

133 Hammers, Wrenches—Two new bulletins, Bulletin BE-15 and Bulletin F-11, have just been issued. One of them describes a replaceable face hammer and rawhide and plastic mallets. The second describes reversible ratchet socket wrenches with complete information as to sizes and weights. Complete descriptions of these tools are given in both bulletins. Greene, Tweed & Co.

VALVES, PIPING

134 Rubber Expansion Joints—This 8 page bulletin AD 137 tells about the application, construction, styles, service and advantages of the company's line of rubber expansion joints. Other information given, includes "How To Order" and a table of dimensions which is accompanied by dimensioned line drawings. The bulletin is well illustrated. The Garlock Packing Company.

135 Lubricated Plug Valves—Reference Book 39—Section 5 covers the company's "Self-Seald" lubricated plug valves. A large cross section wash drawing of a typical valve is presented as a medium for pointing out the features of these units. Brief and concise information is presented on the units and dimensions drawings with specification data presented in a tabular form is also given. The back page of the folder presents "Ways to Lubricate." Homestead Valve Manufacturing Co.

136 New Steel Valves — A whole new group of steel valve designs are described in this recently-issued folder. Outstanding features of the valves are described and sectional and installation photographs are presented. Edward Valves, Inc.

WELDING, SOLDERING

137 "The Advantages of A-C Welding"—This new Bulletin B-4199 is an excellent data book covering the success story of a-c welding. Tabular material lists the "Savings in Wages," "The Savings in Power," the "Savings in Depreciation," and "Savings in Maintenance." Photographs and line drawings are used effectively to point up the features such as "no arc blow," "faster welding," and "ease of operation." The booklet is well illustrated and complete information on the company's line of welders is presented in the back portion. Westinghouse Electric Corp.

TREATMENT

138 Rust Prevention Data Book—This loose-leaf collection of data sheets covers the story of the company's various types of No-Ox-Id Protective Coatings. The first bulletin tells the general story of the char-

SELF OPERATING

EASY TO INSTALL

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POWERS COOLING WATER TEMPERATURE CONTROL for COMPRESSORS DIESEL and GAS ENGINES

Prevents OVER- and UNDER-Cooling • Increases Operating Efficiency • Reduces Consumption of Cooling Water.

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BUCKET STEAM TRAP

THE KECKLEY TYPE B TRAP is made with stainless steel working parts. The cover plate, mounted at a most convenient angle with the body, carries the entire working mechanism of the Trap. It can easily and quickly be removed from the Trap body without breaking any pipe connections.

From the cover is suspended the bucket and lever with valve through a fulcrum plate which serves also as the valve seat retainer. An outstanding feature of this Keckley Type B Trap is the positive alignment of the valve with respect to the valve seat.

This is accomplished through the dual purpose "fulcrum and valve retaining plate," eliminating any possibility of misalignment.

Write for Bulletin No. 52

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acteristics of the protective coatings and the remainder give such data as: Physical Description; What It is Used For; Coverage; Preparation of Surface Before Application; Method of Application; Drying Time; Recommendations for Storage; Fire Hazards; Resistance; and others. Dearborn Chemical Co.

139 Overcoming Salt Corrosion—The part played by corrosion control in the use of brine solutions by chemical and food processors and by salt producers is described in this new 20 page booklet. Contents of the book are about equally divided between a discussion of corrosion problems solved by the two above-mentioned branches of industry. The book is filled with tabular data and photographs. The International Nickel Co., Inc.

140 Industrial Protective Coatings—This new 4 page bulletin on protective coatings introduces latest developments in the line. In identifying each coating and its proper application, this bulletin points out how, as a component in a "system" of coatings, each makes its special contribution towards greater corrosion resistance and a longer lasting job. Typical case-histories are presented in evidence that such specialized coating systems provide an answer to many serious corrosion problems. United Chromium, Inc.

TAPES AND SEALS

141 Scotch Tapes in Industry—This excellent bulletin presents photographs showing the various and sundry uses for Scotch masking tape and other types of Scotch tapes in production, maintenance and other phases of industrial work. The bulletins are practically self-explanatory but they are accompanied by clear text which completely describes the application and use. There are 24 pages in the bulletin and it is bound in a heavy paper, plastic coated cover. Minnesota Mining and Manufacturing Company.

142 How To Make Joints—This is an informative folder on making bell and spigot joints. The folder describes and illustrates three methods by which tight and lasting joints of this type can be made with the company's compound, which has been developed specifically for the purpose. It explains in detail how the material is applied, and tells the quantity which should be used for different sizes of pipe. Smooth-On Manufacturing Company.

MISCELLANEOUS

143 Permanent Magnets Bulletin—Bulletin B-1205A describes this company's high intensity Perma-Plate magnets for removal of tramp iron from food, chemicals, coal and other materials. It shows how these magnets can be installed in or above wood or metal chutes, ducts, pipes, hoppers, spouts, conveyor belts, feed tables and other places, where extraction of destructive tramp iron is necessary for protection against machinery damage, product contamination, fires and explosions. Dings Magnetic Separator Company.

144 Air Conditioning Units—Bulletin C-1100-B33 describes air conditioning units for commercial and industrial applications. This 8 page bulletin describes operating and construction features of the unit, gives specifications and several tables of physical data which include fan data, water coil data, steam heating coil data, etc. Worthington Pump and Machinery Corporation.

145 Cooling, Heating—Catalog 248 is a 4 page bulletin describing the company's convectors, unit heaters, air conditioners, heating coils and cooling coils. Each of the separate items is illustrated and tables of engineering data giving motor horsepower and speed, Btu per hour and other information is included. Young Radiator Company.

146 Lubrication Hand Book—This 48 page rotogravure handbook has many features. A highlight of the booklet is the "barrel-to-bearing" selection guide. The pictorialized presentation of the guide makes it easy for plant engineers, purchasing agents and other buyers to select correct lubricants and equipment for every plant need and helps reduce production costs. The illustrations show actual applications of various types of lubricating equipment in the plant and brief captions tell how the particular piece of equipment is being used. Alemite, Division of Stewart-Warner Corporation.

147 Silicone Notebook—This new booklet, Dow Corning Silicone Notebook, Fluid Series No. 3, contains the most comprehensive body of information available on the properties and behavior of the DC 200 Silicone Fluids. These semi-inorganic fluids are notable for their heat stability, shear resistance, relatively constant viscosity over a wide temperature range, lubricity, water repellency and good dielectric properties. Their usefulness as damping and hydraulic media, as liquid dielectrics, as special purpose lubricants or as additives, impregnants or coatings has been established in almost every field of industry. Dow Corning Corporation.

148 Steam Generators—Bulletin B-3250A describes this company's line of steam generators. The bulletin besides describing the units is almost completely devoted to dimensional diagrams of standard steam generators with tabular and chart material giving dimensions, typical performance data at various percent ratings and sectional diagrams of various models. Titusville Iron Works Company.

149 Steam Specialties Data Booklet—Bulletin 52 is an excellently-done piece of literature which covers the company's line of pressure regulators, temperature regulators, combination pressure-temperature regulators, inverted bucket steam traps (a new product) and self-cleaning strainers. Complete descriptions of these products are presented along with tables of dimensions and other pertinent data. Typical installation arrangements are described and illustrated. O. C. Keckley Co.

150 Adhesives for the Plant—Plant and Industrial adhesives are covered in a recently-revised catalog section. The section describes the range of the products and their applications, gives classifications of various types of rubber cements and services requirements and detailed instructions on "How to Apply." Data on standard containers are included. The B. F. Goodrich Co.

151 Separators and Exhaust Heads Data Book—Catalog No. 500 has just been issued by this company. This data book is exceptionally well arranged, each page being a unit in which is described the particular item under discussion with included special information and dimensional data. Auxiliary or accompanying equipment is also mentioned in some cases. Considerable engineering data such as "Pressure Drop Chart" and directions for use, table of flow of steam in pipes, and other tabular and chart material are given. Wright Austin Company.

Now! Extrusion damage eliminated!

AMAZING NEW G-T RING PACKING INTRODUCED AT POWER SHOW

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PALMETTO® PACKINGS

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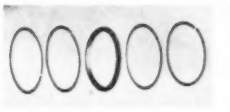

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Extrusion of packing material into clearance between mating parts *absolutely eliminated* by new Greene, Tweed Palmetto G-T Ring Packing!

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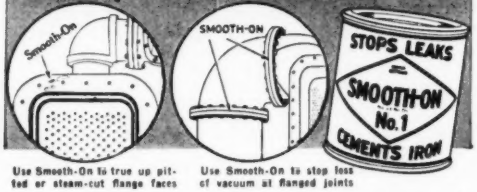

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THE IRON CEMENT OF 1000 USES

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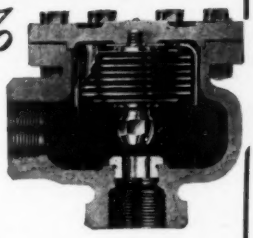
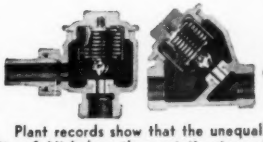
2 to 6 Times More Drainage Capacity Speeds Circulation





Bulletin 1047 or see Sweet's

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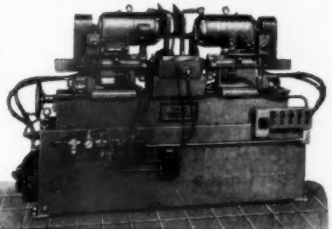

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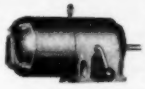

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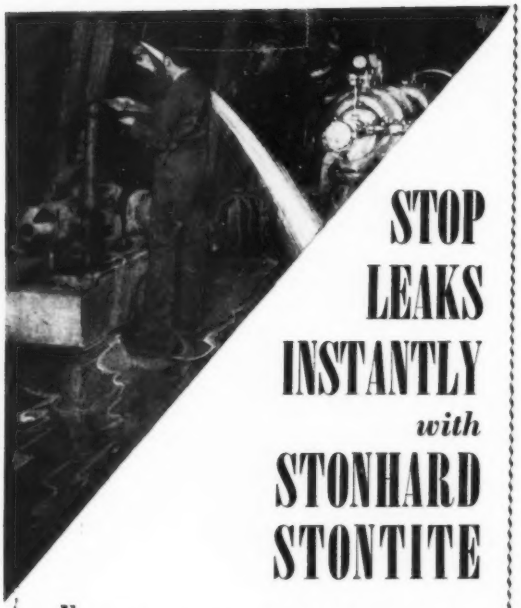

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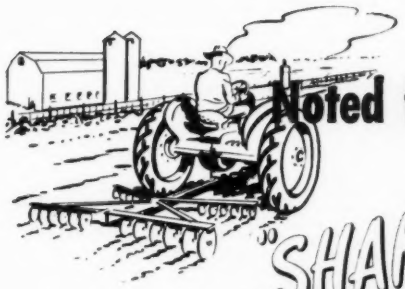

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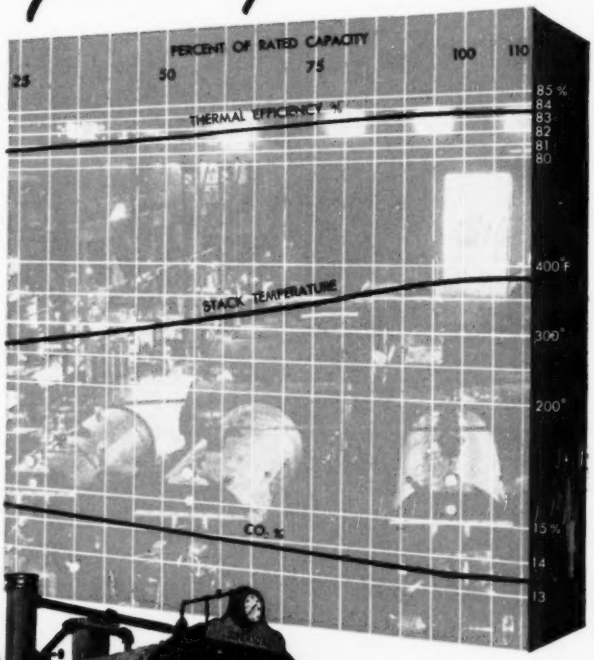

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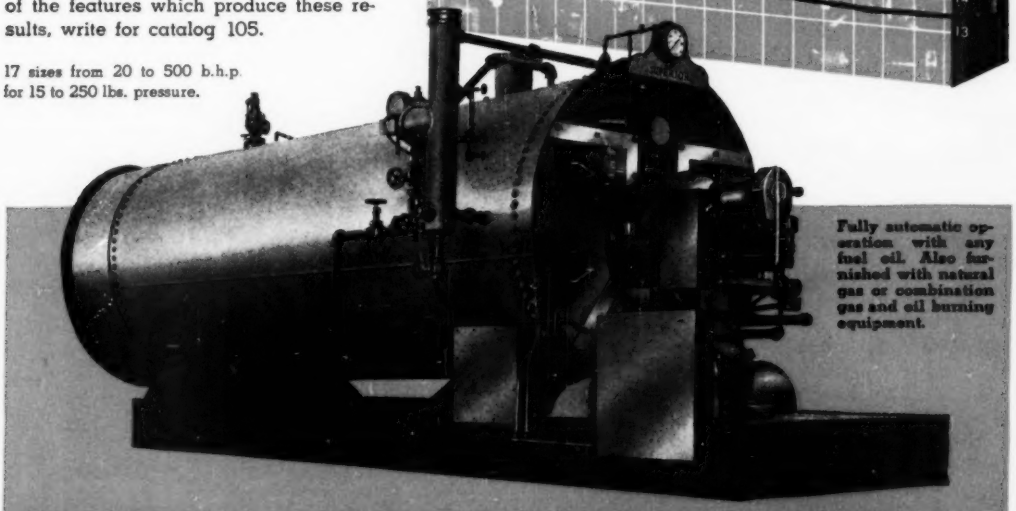

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